Electrical Review

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Outlook for Fall Trade Promising

WHAT is the business outlook in the electrical industry? Will the coming months bring improvement or will the factors that have been hampering trade increase in their effect?

One hesitates to conjecture, let alone predict, for it is of little avail. Nevertheless, there are some outstanding features that give foundation for the belief that electrical trade will continue good for some time to come. Facing innumerable difficulties and perplexities, chiefly in the lack of labor, transportation and raw materials, business has gone on apace for the past year or two. The demand for electrical products has far exceeded production. Until the supply approaches more nearly the ever-increasing need of electrical goods there can be no appreciable let-up in business. The law of supply and demand governs, and there can be no better illustration of it. The problem is one of production more than marketing.

Added to the encouraging fact that there is an excessive demand for electrical products is the optimism with which the situation is viewed by the electrical trade. Manufacturers in all lines express themselves confident that production problems will be overcome and that a lengthy period of prosperity is ahead of us. The rapid and natural increase in the use of electricity, taken together with the demand that will come as a result of past curtailed construction and activity in other branches of industry, indicates that this attitude toward the future is correct.

Transportation and fuel problems are the most serious. If the rates granted the railroads prove sufficient to enable them to purchase the necessary equipment for handling the enormous volume of freight offered, it is conceded that the transportation factor will be worked out satisfactorily. This will mean heavy buying of all commodities, not only the raw material but the finished product also.

The electrical industry is coming in for its share of the prosperity and "every effort to increase production" should be the keynote of the present time.

Outstanding Features of Business

Optimism Prevailing Sentiment Among Outlook Encouraging, Predicting Better in Volume of Sales—Transportation and

The most significant fact brought out in connection with a survey of business conditions and the outlook in the electrical industry is the general feeling of optimism that prevails. Expressions of encouragement come from every factor in the electrical trade. The demand for equipment is good, and new business in most lines seems to be plentiful. Sufficient raw materials are apparently available for current needs, with reasonable promise of fulfillment of future requirements.

These indications appear in spite of the fact that inadequate transportation facilities are greatly hampering the movement of raw materials and finished products. It cannot be gainsaid that in nearly every department of business activity it is found to be very difficult, if not actually impossible, to deliver goods at a desired point with any degree of promptness; in other words, we are suffering from a bad case of delayed transportation. It is generally believed that the proper remedy to alleviate this condition was applied recently when the Interstate Commerce Commission granted rate increases to the railroad companies.

The necessity for an advance in railroad rates had long been beyond argument, but even among those who regarded this advance as necessary there had been considerable doubt as to the effect upon prices of products which move on a tonnage basis. Temporarily the effect of these rate advances will be reflected in prices of bulky articles, although there should be little or no reflection in prices of articles, the value of which is relatively high in relation to weight. Certain offsetting circumstances are not to be ignored, however.

Railroad Rate Advances Expected to Improve Business Conditions.

As long as the railroads were unable adequately to expand their facilities to handle the freight offered to them, business in all lines suffered under a most serious handicap because of hampered transportation. In some cases this has been reflected violently in prices. If the rate advances enable the railroads to build up their plant and equipment sufficiently to handle freight, expansion of production in all lines will become possible, and the friction involved in the present process of distribution will be eliminated. It will take a certain time to reach this result, but when it is attained the final effect of increased rates will be to lower prices.

There is a strong belief in a gradual and natural readjustment of business conditions without financial disorder or economic calamity. Tight money, unrest of labor, the loosened bonds in some phases of social life, the Russian-Poland war and the high cost of necessities are enumerated as disturbing business factors, but there is no need to become panicky over any of these matters, for the reason that a widespread feeling is manifested that business will continue good for some time to come.

Amid all the cross-currents and eddies of the industrial situation a definite trend seems to be slowly developing toward a gradually increasing gain of supply upon demand and a somewhat lower level of prices. Copper is dull because of a supply not yet disposed of. Construction and building are still below normal because of high prices and scarcity of both labor and materials and the practical withdrawal of credit accommodations on new construction. Some essential materials of building are scarce, notably cement and wire nails. Lumber can be had but cars for transporting it cannot. Coal mining has its flock of troubles, the principal ones being strikes and lack of cars.

There are indications that many commercial borrowers, in response to expectations of a credit stringency during the fall which has prevailed for many months, have at least to some extent anticipated their autumn requirements for credit. This factor, coupled with the continued tendency toward reduced volume of business and lower prices for many commodities, may be expected to relieve the pressure of commercial and industrial credit requirements. It must be recognized, however, that some little time will be necessary for this relief to make itself manifest, because of the interval which must elapse before a new policy of business brings evident results.

Conservatism and Stability Reflected by Business Interests.

Although superficially not much change is evident in the general business situation from that of midsummer, nevertheless underlying intrinsic conditions are slowly and steadily making for a sounder situation. An important element is the determination of business interests to carry into effect a new policy of conducting their affairs on sane and conservative lines, looking toward stability and continuance in business rather than to the policy which until recently prevailed of doing as much business as possible at high prices on a basis of excited public buying with resulting abnormal profits.

With few exceptions, the wholesale markets are now in a condition of inactivity not paralleled since the period of uncertainty which followed the signing of the armistice. Normally, this is the dullest season of the year and the condition of stagnation is partially to be ascribed to that fact. To a far greater extent, however, it is the result of a widespread realization which has at last become general throughout the business community, that the present downward price movement is not a temporary tendency but a decline toward a new level applicable to postwar conditions, a level which can be found only by cautious experimentation in the market. It is possible that in some commodities this new level has already been reached.

Statistics show the existence of a great need for copper, present and prospective, but trans-

Conditions in the Electrical Trade

Various Branches of the Trade—General Business Conditions and Large Increases Labor Problems Are Serious Deterrents

portation, labor and credit conditions are still chaotic and there is no certainty as to when this need will take the form of continuous buying on a large scale. One manufacturer sums up the situation in these words: "When we have sufficient men we are short of raw materials. When we have sufficient raw materials we are short of men. When we have sufficient men and raw materials we are short of power due to lack of coal."

This statement may exaggerate conditions somewhat, but it is substantially true of many industries, and it seems to be the most reasonable explanation why the market has not responded to a number of favorable conditions, among which are the following:

The strike in the Connecticut valley has apparently collapsed. It lasted nearly four months and involved about 10,000 men. Under normal conditions the brass mills in that locality consume 1,000,000 lbs. of copper daily. The rise in railroad rates should affect the copper market in two ways. Transportation charges for all material to and from mines, smelters and refineries will be increased. At the present price of copper it is not likely this additional cost will be absorbed by producers. If the rates granted the railroads prove to be commensurate to their needs, it will mean heavy buying by them of materials of which copper will form an important part.

Men in Electrical Industry Give Views on Business Conditions.

In the following paragraphs are given expressions by representative executives in different branches of electrical trade as to business conditions—the demand for equipment, the situation regarding construction, raw materials, freight shipments and other problems affecting the industry.

J. C. Bayton, General Manager, The Adapti Co., Cleveland.—While the demand for electrical material is easing up we do not look for any so-called slump in the electrical industry. There is enough business that has been held over and new projects that have been temporarily postponed to insure good business for some time. We believe business will be easier for the next month or two.

G. E. Eckert, Manager, Publicity Department, R. Thomas & Sons Co., East Liverpool, O.—After a 12 months' watch in the direction of our markets, we fail to find any semblance of let-up in buying. The demand for both high and low-voltage insulators appears to be steadily on the rise, buyers are becoming more and more insistent for materials, and new business seems to be plentiful. The real danger comes, however, in the buyer's eleventh hour placement of orders. Deliveries can no longer be considered in units of days, and the buyer should calculate his requirements well in advance so as to allow the manufacturer plenty of time to schedule his heavily taxed production. There seems to be no doubt but that the electrical industry has an exceptionally bright future for several years to come.

W. R. Herstein, Vice-President and General Manager, Electric Supply Co., Memphis, Tenn.—In this section at the present time there is no falling off in demand, though we find collections becoming quite difficult. We are looking for a continued brisk demand during the balance of the year, particularly on building material. So far as our experience goes, the supply is still considerably short of the demand. With regard to heating devices and other household appliances, apparently the manufacturers are catching up with their orders, and we do not look for a scarcity in these lines during the coming fall. We believe, however, that with the increased advertising and exploitation of household electrical conveniences the demand will be fully equal to the production, and we are in hopes of enjoying a nice business between now and the end of the year.

H. J. Dyett, President, Rome Wire Co., Rome, N. Y.—Optimism is a word that adequately expresses our opinion of the electrical business for the future, so far as we can look ahead. The high prices of labor and fuel, together with the prospect that public service corporations will have fairer treatment from the public and lawmakers in the future, lead us to expect a larger electrical development in the future than the past has ever seen. The electrical luxury article of today will be the electrical necessity of tomorrow. If the electrical industry will be actuated by the desire to obtain only a fair profit and discountenance all profiteering, we see no reason why we should not have continuous good business covering a considerable period.

E. J. Rueth, Sales Manager, Frankel Light Co., Cleveland.—We believe there is now, as there has always been, an abundance of raw material, the market shortage of the past year or two being a reflection of our inadequate transportation facilities coupled with an abnormal demand. Demand is again normal and labor is plentiful despite reports to the contrary. The recent decision of the Interstate Commerce Commission permitting the railroads to increase rates to an aggregate of approximately $1,500,000,000 is a development of far-reaching significance. Wages have been increased to the point where the railroads can meet industrial competition for capable men and at the same time compete with industrial enterprise for the capital needed to develop the transportation systems. We have every confidence to believe that the increased efficiency of employe and employer resulting from these advances will solve our transportation problem.

Overstrained credit facilities account for the present limited possibilities of business at home, while the rate of foreign exchange is rather discouraging to exporters as well as foreign im-

porters, and like all big problems the period of readjustment will take some time. Step by step, slowly and a bit haltingly, yet with multiplying evidences of sureness, our country and business are adjusting themselves to their normal basis. It is to be hoped that this point will be reached by 1921 but hardly before. On the surface, the outlook for at least part of our industry this fall would seem rather discouraging, but things are not always quite as they seem on the surface. To be wholly fair with ourselves in this amazing situation, it is necessary to look at more than the surface facts.

There is not at present under construction or will there be for the balance of this year the new home building that we all expected, and we must, therefore, look to other fields, namely, old house-wiring, appliances and convenience outlets. The possibilities of this field are unlimited when we consider the vast number of houses that are not wired. The finest homes in a good many localities still use gas for illumination, not because the owner can't afford the modern illumination, but the proposition with its advantages has not been properly presented. A properly conducted old house-wiring campaign is one of the most profitable investments a contractor-dealer can make. In addition to his profit on the job every house wired means a new customer for washers, flat-irons, sweepers, lamps, etc., and the astonishing fact is that seven of every ten customers of this kind will buy their appliances from the dealer who wires their home, and, with a systematized follow-up, this average can be brought up to nine of every ten. Then there is a large number of homes that are wired without any convenience outlets. Appliances cannot be sold to this class as they have no convenient way of using them. The convenience and labor saving of the large amount of appliances of necessity that we have to offer to the public, when properly presented, will more than make up for any temporary let-up in new construction. This means merchandise attractively displayed, advertising campaigns and a systematic follow-up of all prospects, and it is just as important that contractor-dealers should make it their business to see that these appliances are properly installed and that the customer understands how to operate them.

F. F. Uehling, President, Uehling Instrument Co., New York City.—Whether we think of the electrical energy sent out over the wires from the electrical power plant or of the devices that convert this energy into some form of service—electrical "servants" in the home or electrical horsepower in the factory, mine, railroad, etc.—we cannot avoid the conclusion that the electrical industry will be called upon for a long time to come to help in making up for our shortage of man-power and maid-power. That seems to assure the future of the industry. But there is one very dark cloud on the horizon, namely, fuel supply. It cannot be denied that fuel is the most important raw material because all else depends upon it. The threat of continued acute shortage does not conduce to a comfortable feeling. As a result, fuel consumers are showing more interest in means for stretching the coal pile (and the fuel oil supply) than ever before. For a good many years back our most enlightened economists have been preaching that large savings can and should be made in the boiler room. The first stage of any process is the logical place to make the first step towards economy; nevertheless, for years it was quite the vogue, even in otherwise progressive plants, to improve economy in the generating and distributing departments to the *nth* degree while trusting more or less to luck in the boiler room. But today the demand for boiler-room instruments is tremendous. It is now realized by plant managers that they are the eyes and ears which enable the engineers and firemen to penetrate furnace and chimney walls and boiler-shells to detect and arrest waste—to make the laggards carry their fair share of the load, and above all to keep tabs on and prevent the biggest loss of all, that is, the fuel wasted up the chimney. The silver lining on the fuel shortage cloud is the very intense, although belated, realization that fuel shortage can best be fought with efficiency.

Eugene A. Rumsey, President, Rumsey Electric Co., Philadelphia.—We think it will be seen that the railroads will move more iron and steel products. At the same time they will take care of the harvested crops with the increased demands upon their rolling stock. This is all due to settling the question of an increase in wages to the railroad employes and the permission for the railroads to increase their rates so as to more than take care of their wage increase. We can not see any indication for the supply to even catch up with the demand for at least six months to come, and feel that it is safe to buy and keep stock at the maximum point. We think you will find that there will be fewer strikes due to the agitation for open shop. With no strikes this country at this time cannot help but be prosperous, even though it is a presidential election year.

Murray O. Main, President, Main Electric Co., Cleveland.—The demand for our product has weakened the past few weeks, as always at this time, for several years past. The farmer is too busy harvesting his crops to buy equipment now, but this early fall will, as usual, start in and buy more briskly than ever. Our export business has been excellent and from all indications we expect to do a better business this fall than ever before. Prices will hold up for some time to come it seems, but in due time may recede slightly.

S. E. Bramer, General Manager, Copper Clad Steel Co., Rankin, Pa.—We are of the opinion that business will continue in about a like volume as it is today. We do not look for the general increase in business this year, due to many important reasons: first, unsettled labor conditions, and, second, unsettled railroad policy, with a lack of equipment. We believe that if those two factors were improved we would have very prosperous times for a number of years. The railroads must first of all be placed in good condition, with additional new equipment to take care of the shipping demands. The producers can only secure 25% of their car requirements. This very factor is causing a tremendous increase in the price of coal, in fact as high as $12 a ton, a price unheard of and uncalled for. Manufacturers are unable to ship and have a great deal of difficulty in receiving material. With these problems before us, we cannot see a great business this winter. We do hope our entire country will realize that the railroads are part and parcel

of ourselves and that we cannot exist without them and that we should take more interest than paying for mileage or transportation, but try in some way to be part and parcel of the great institution that helps to maintain progress of our entire country.

Louis Desloge, Killark Electric Mfg. Co.. St. Louis.—It is our opinion that conditions will remain about normal (we would consider that present conditions average normal) as long as freight conditions remain about the same as they are. If freight conditions improve—in other words, if freight begins to be handled on a better basis—we believe there will be a certain downward tendency to prices but not necessarily any slacking up of business. On the other hand, if the freight conditions get any worse, that is, slower movements and more congestion in the large shipping points, we believe that there will be an upward tendency to prices. Local trade conditions in all parts of the country, we believe, will be influenced to a large extent by labor conditions.

M. H. Gray, President, Gray Electric Co., Springfield, O.—We believe that the average contractor-dealer should be a cold-blooded buyer during the next few months, preparing his organization and his stock of merchandise for a change from the present seller's market to a buyer's market, preparing for the old-time, competitive, get-up-and-hustle conditions. We do not, personally, look for any "panicky" change in prices, but we do believe that the contractor-dealer who has been sitting back and enjoying a very large patronage must wake up and be right up on his toes all the time, which certainly will be some change from what he has been doing in the recent past. We look forward to the future with a good deal of optimism, feeling that there is a much greater opportunity for successful merchandising now than there ever has been before.

William H. Hobart, Hobart Brothers Co., Troy, O.—It seems to us the coming months are going to be extremely successful for the manufacturers, jobbers and dealers who are responsible and pick up the trade. Business conditions are changing so fast that stock should be kept to the minimum and all avenues of supplies kept in touch with. We anticipate an unusual demand in motor equipment. These summer months have been unusually satisfactory for us in volume of sales, and we anticipate an unusually large business in the automobile trade during the fall months because garage men are turning to battery-charging repair business to make up profits that normally would come through sales in cars. On the whole, we anticipate an unusually good volume of business and feel that the trade will be profitable as soon as it gets over its nervousness of the customary summer slump in electrical lines.

M. F. Falk, President, Union Electric Supply Co., Providence, R. I.—We are very optimistic as to the amount of business that it will be possible to get this fall and believe that prices will maintain their present level; on some lines, we expect to see considerable price advances. The lack of freight cars and general chaotic conditions of transportation lead us to believe that material, especially items such as steel, will be at a premium due not to price advances but to the impossibility of obtaining same.

K. G. Mann, Advertising Manager, Harvey Hubbell, Inc., Bridgeport, Conn.—I can say from personal observation and general connections in this field that all those people who are in the game feel very optimistic and are not worrying a great deal about trade conditions, lack of production or equipment, but are settling down to good hard work, feeling that ultimately as water seeks its own level production will catch up with demand. The business which people now call big is very small in comparison to what the future holds forth in the visual eye of the electrical manufacturer, jobber, contractor and dealer. The day is not far distant when the slogan "Do It Electrically" will be antedated and thrown aside, for we are in an electrical age which is only in its infancy. We believe that the present trade conditions are all that could be expected and that co-operation is becoming more and more the ultimate object of competitors as well as friends in the industry. It is only a natural sequence that the lack of production will affect the demand for equipment, but we do not believe that there will be any lack of production, for this is only a temporary issue resulting from causes which have usually followed all wars and general upheavals in our national life. There is no man today who is a prophet in regard to trade conditions, etc. The paramount thought for all of us is to get busy and be busy doing so.

E. S. Sanderson, Sales Manager, Scoville Manufacturing Co., Waterbury, Conn.—Our outlook on the electrical industry is, of course, somewhat limited as we are principally concerned in supplying the manufacturers of small wiring devices with brass and bronze, with shells and caps used in their sockets and switches and with machine screws, but we do not notice any lack of business along these lines. In fact, the demand apparently this fall is going to be as great as any time in the past. It seems to us, therefore, that the future is going to depend very largely on the financial condition of the country.

Ralph Poppenheimer, Specialty Device Co., Inc., Cincinnati.—In our particular line the demand for guy anchors, guy wire protectors and other pole-line equipment which we manufacture is rather limited, this being due to the fact that utility companies wishing to make extensions are unable to secure all of the material necessary for such extensions. The difficulty of obtaining construction material is of course due to a lack of production, the freight situation, and similar disturbing factors. For our part, we have not noticed any decrease in price in any iron or steel products and do not anticipate any decline for some months, as the demand still seems to be far greater than the supply, particularly in view of the many tons of steel which are piled up at the mill awaiting transportation to the consumer. Referring to the business outlook for the future, we believe this to be very favorable, as there is an immense amount of construction work which has been deferred for the past three or four years, and a great deal of this work will be started as soon as conditions with respect to material, labor and transportation are more favorable.

Electrical Industry Important in Foreign Trade

Electrical Exports Aid Sales of Allied Materials as Well as Insure Prosperity of Industry Itself — Every Section of the Country Benefited by Foreign Trade in Electrical Products

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The participation of the electrical industry in the foreign trade of the United States is of very considerable magnitude. Consequently, electrical exports constitute a powerful factor in insuring the prosperity of the industry itself, in preventing the unemployment of labor and in contributing to the maintenance of wages. There are many allied lines of machinery which are essential adjuncts in the use of electrical products and which are exported as a result of that association. The prosperity of such industries is closely bound up with that of the electrical industry. Finally, the ramifications of the electrical industry and its dependence upon other industries are such that its condition of prosperity directly affects through these contacts the welfare of a host of men, women and children in this country.

As to the important part played by the electrical industry in the foreign field, reliable figures indicate that the production of the electrical manufacturing industry in the United States during 1919 was about $900,000,000, of which over $90,000,000, or 10%, was exported. This export figure of $90,000,000 was an increase of 50% over the amount exported in 1918, when we exported $60,000,000. This is perhaps as great a percentage exported as in any other manufacturing industry in this country, with the exception of typewriters, cash registers, harvesting machinery and a few others.

It is worth while to note the destination of these electrical exports. Over 40% went to North and South America, Canada, Brazil, the Argentine and Cuba being our best customers in the order named. Over 25% went to the Far East, Japan, China, Australia and India being our principal customers in that part of the world.

Europe took about as much as the Far East. Our principal customers in Europe were Great Britain, Norway (which gave the United States over $4,000,000 worth of electrical business, a surprisingly large amount for so small a country), France, Italy and Spain.

This high level of electrical exports during 1919 has been attained in the face of foreign exchange rates, which have become increasingly unfavorable. But the demand for electrical products in Europe especially has been urgent and insistent, so necessary is the utilization of electrical power regarded for the industrial rehabilitation of Europe.

The fact that American electrical manufacturers have been able in general to maintain prices means that this export business has not been handled at a loss, or in the way of dumping surplus products. It has been developed as a vital and necessary part of their whole business.

Foreign Sales Help to Maintain Production in American Factories.

How important this foreign business has been in maintaining the production in American factories in lines in which the domestic demand has temporarily fallen off may be seen from the fact that, while foreign business as a whole was only about 10% of that production, in many instances it became a far greater percentage, offsetting a decline in domestic demand. For instance, in the case of certain materials, such as turbine sets, the foreign demand was about 25% of the total; for street-car equipment it was 60%, and for electric railway locomotives still higher.

The falling off in domestic demand for these items reflected the financial difficulties of central stations and electric and trunk-line railways in the United States, which, because of more or less stationary rates, had to face a rapidly declining net income, and in the tight money market found it difficult to finance any considerable purchase of new equipment.

The increased export demand for these items of equipment meant that the manufacturers and their employes were relieved of the necessity of extensive layoffs or expensive shifting of labor.

Any factor like this, which helps to stabilize demand and consequently production, does a great deal to insure a steady income to the workmen and to prevent the distress and complication attendant upon unemployment.

The export of electrical manufactures aids not only the electrical industry of the United States but also the manufacturers of allied machinery and materials, the sale of which goes hand in hand with the sale of electrical machinery.

Statistics show that where American-made electrical machinery has successfully entered foreign markets there has been extensively sold allied machines, such as boilers, condensers, pumps, waterwheels, hoists, mining machinery, sugar-mill machinery, rails and accessories, and a host of like material.

Exploitation by American Electrical Manufacturers Helps Those in Other Lines.

The intensive exploitation of foreign markets by large electrical manufacturing companies has done much to open those markets for the products of other American manufacturers. This intensive cultivation is largely responsible for the

wide prevalence of American engineering practice in many foreign countries. And this again has reacted favorably upon the exportation of a wide variety of products of American manufacturing industries.

At a recent meeting of the shareholders of the Siemens & Halske Co., of Berlin, Karl F. Von Siemens, chairman of the company, emphasized the fact that the manufacture of electrical goods belongs to that class of industry which can do nothing with purely raw materials alone but also depends on the articles produced by other industries. Indeed, it may be said that more than any other industry, electrical manufacturing draws upon the products of the soil and the output of mines, and, in no less a degree, the manufactured articles of other industries in a finished and semi-finished state.

The accompanying map, while showing the location of plants manufacturing electrical machinery and supplies, indicates only a few of the materials entering into these manufactures and then only the raw materials. It does not indicate the location of other industries which contribute innumerable articles required in the manufacture of electrical machinery and supplies.

In addition to the raw materials, the source of which is approximately indicated on the map, there are very important items such as cotton yarn, cotton cloth and cotton tapes manufactured in the United States.

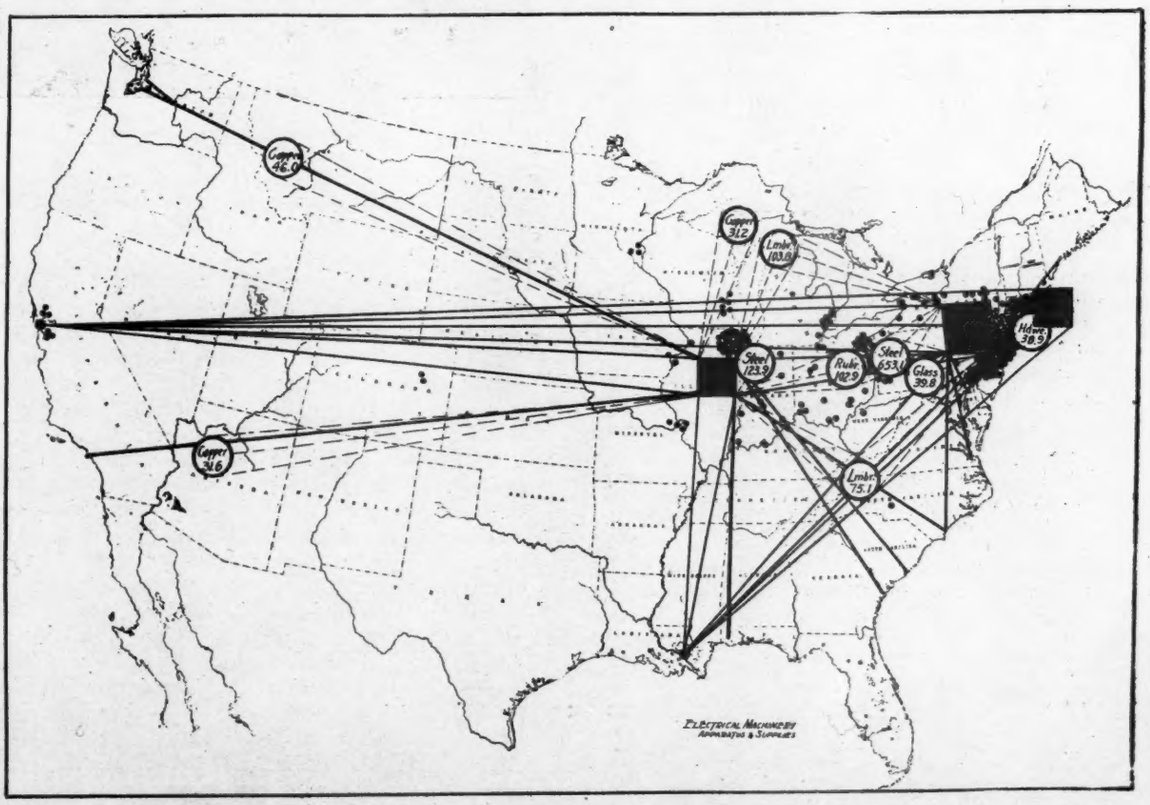
From the East also there come copper shapes and brass, manufactured in endless variety; such articles as dry goods, textiles and paper products; for construction purposes almost every kind of machinery, and for production purposes machine tools, these coming for the most part from the Middle States.

Other articles which lead in the list of domestic commodities and which are required by the electrical manufacturing industry, in addition to those already mentioned, are the following: Vulcanized fiber, porcelain materials, steel wire, metal alloys and petroleum wax from the East; aluminum, hardware, coal, coke and pig iron from the Middle West; asbestos, mercury, rutile, turpentine, rosin, oils and pitch from the South; mica and slate from the North, while the West furnishes many of the articles already mentioned, and, in addition, the raw items of gilsonite, lead and spilter.

Every Section of Country Vitally Interested in Electrical Industry.

This list is sufficiently long to indicate that the electrical industry is of vital importance to every section of the United States. Moreover, the export of electrical goods contributes to the commercial activites of the important seaports of the Atlantic Coast, and of the ports of New Orleans, San Francisco and Seattle. The prosperity of the ports on the Pacific and on the Gulf will be greatly enhanced if our electrical business with Latin America and the Far East continues at its present rate of growth.

With the certainty of the depreciation of



Graphical Presentation of the Electrical Manufacturing Industry in the United States.

Each dot represents the location of five electrical manufacturing establishments. The large white circles indicate the centers of allied industries and value of the production is expressed in millions of dollars. The large squares indicate the chief centers in which the raw material is made ready for consumption. Thus, in the Boston district the amount of electrical machinery and supplies totaled $49,869,000; in the New York district, $159,062,000, and in the Chicago district $45,667,000. The heavy solid lines show the paths of the finished products in leaving the United States. The broken lines show the direction of raw materials in moving towards the centers of manufacture.

European currency continuing for a long time to come, and thus the maintenance of a barrier against exports to Europe, more and more does it behoove the American manufacturers to look to those markets which are not affected by unfavorable exchanges. With the inevitable falling off of exports to Europe, new business must be secured from the markets of South America and particularly from those of the Far East. New competition requires new business methods and the demand for electrical material will not be maintained at its present high rate unless there is created a demand for new kinds and new uses of electrical goods.

In the development of electrical projects, also, American interests can do far more than they have done in the past by aiding in the financing of such developments without which many of them can not and will not be undertaken in the near future.

American trade has been given a tremendous impetus during the years of the war and the months which have followed the cessation of hostilities. Whether we shall retain our dominant position and not revert to our restricted and provincial pre-war position will be determined by the answer to this question: Do American merchants, manufacturers and capitalists desire to play the international game?

If this answer be in the affirmative, American enterprise no doubt will overcome the chief handicap to our attaining this position which is found in our relative inexperience in the sphere of international politics, finance and commerce.

SHIPS DRIVEN BY DIESEL-ENGINE GENERATOR SET.

Fuel Economy and Flexibility of Design Are the Outstanding Features of Most Recent Propulsion Developments.

An electric generator driven by a Diesel engine comprises the most recent development in ship-propulsion power plants. Such equipment is now used on two American vessels, the *Elfay* and the *Mariner*. The *Elfay* is a schooner of 313 gross tons and employs the new type of drive as an auxiliary to her sails. Her main engine is a Winton six-cylinder full-Diesel oil engine, which runs at 425 r.p.m. and is directly connected to a Westinghouse 75-kw., 125-volt, d-c. generator. Power from this generator is supplied to a 90-hp. Westinghouse motor which is directly connected to the propeller.

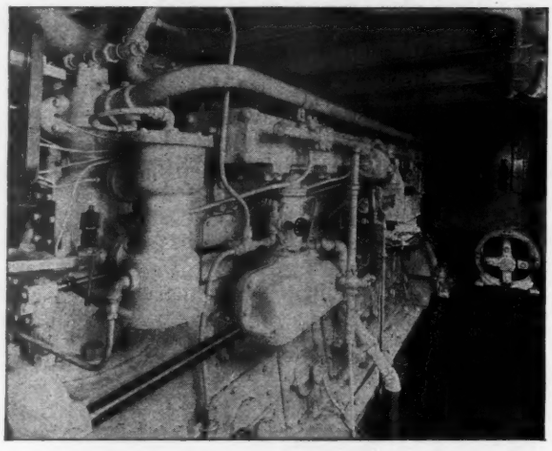
TABLE SHOWING COMPARISON OF FEATURES OF DIESEL AND STEAM-ELECTRIC DRIVES.

Feature.	Diesel-Electric.	Steam-electric.
Engine	Intern. combust.	Steam turbine
Engine speed	Under 500 r.p.m.	Above 1000 r.p.m.
Minimum fuel per shaft horsepower	0.45 lbs. per hr.	1.0 lbs. per hour
Kind of current	Direct	Alternating
Voltage	Under 600 volts	Over 1000 volts
Maximum power	4000 hp. (about)	Undertermined
Special advantage	Fuel economy and flexibility of design	Unlimited power and flexibility of design

This equipment is operated and controlled directly by the navigator. Once the engine is up to speed, the engineer has nothing further to do except to keep it running properly. On the deck, just forward of the wheel, is a handle mounted on a pedestal. By turning this handle to the left, the propeller is started and brought gradually up to full speed in a series of several steps. The propeller stops when the handle is turned back to the off position, and by turning the handle around to the right the propeller is reversed in a similar manner. The full speed of the yacht under power is 8.5 knots, and the rotation of the propeller can be changed from full speed ahead to full speed astern in less than five seconds.

Flexibility of Design and Maneuvering Are Features.

Among the advantages of the Diesel-electric drive are flexibility of arrangement, ease of control and exceptional maneuvering power. However, its great advantage is its high fuel economy, the internal-combustion oil engine being able to produce a given amount of power on from one-half to two-thirds less fuel than any form of steam engine. This represents a saving of such great importance that this type of drive will undoubtedly be widely used within its field of application. As applied to the ordinary commercial vessel, there will usually be two or more engine-driven generators so that the ship can proceed even if part of its propelling machinery is out of commission for any reason.



Engine Room of the "Elfay," Showing Installation Diesel-Electric Drive.

Diesel-electric drive is characterized by an engine of comparatively slow speed driving a low-voltage d-c. generator. The amount of power that can be generated by this method is limited because, when a certain point is reached, prohibitively large cables would be needed and the heavy currents could not be handled by the commutators of the d-c. motors. Hence, oil-electric drive, unless developed along new lines, will be confined to vessels of small or moderate size, but in this field it appears to have no competitor.

SERVICE SUSPENDED 24 HOURS FOR WANT OF COAL.

Owing to lack of fuel, the Hornell (N. Y.) Electric Co. was forced to suspend service on Aug. 18, affecting the street-railway system, lighting customers and a number of large industries. Service was resumed about 24 hours later, with receipt of coal.

Substations and Switchgear for Overhead Systems

Fourth of a Series* of Articles Giving a General Review of the Electric Power Situation—Comment on Present-Day Practice in Operating and Equipping Transmission Lines

By ALFRED STILL

Great progress has been made in recent years in the construction of outdoor substations on high-voltage alternating-current systems. Large self-cooling transformer units are now being made for use out of doors, and switchgear, both of the oil-break and air-break type, is being designed to give satisfaction under the most severe weather conditions. It is usual to house the low-tension switchgear, but the advantages of having high-voltage bus bars, disconnecting switches, lightning arresters and choke coils in the open, where ample clearances may be provided at comparatively small cost, are being recognized.

Apart from the design of the apparatus itself, a great deal of attention must be given to the general layout and arrangement of bus bars and connections in a high-tension outdoor substation of any magnitude. There are at present many excellent examples of properly designed outdoor substations in regular operation.

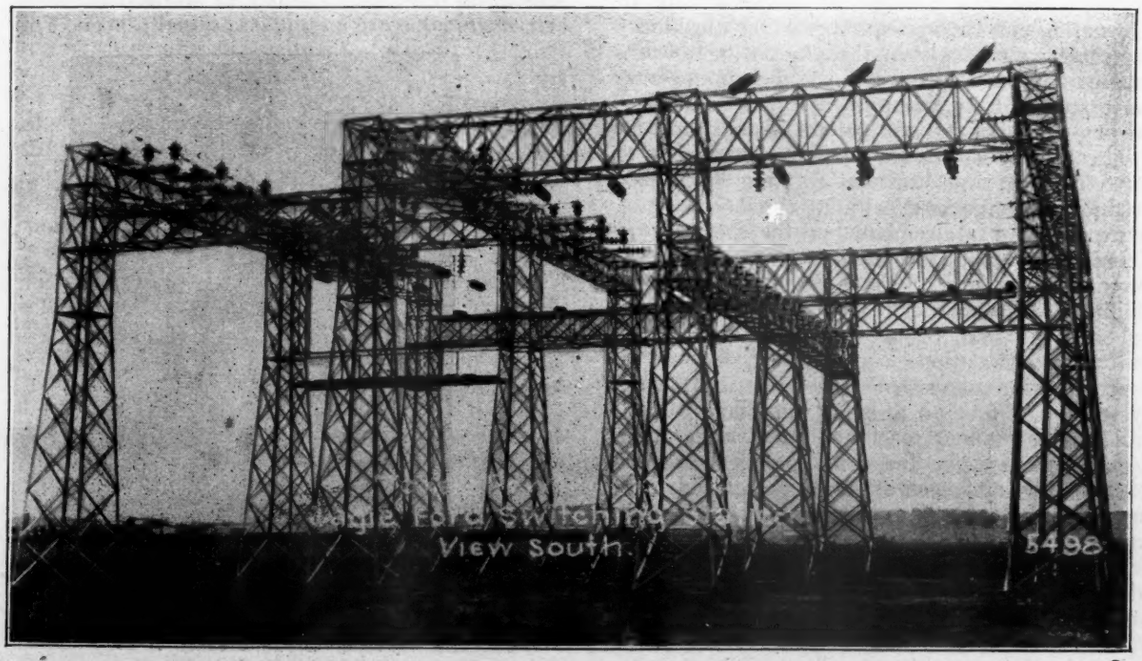
The steel structure should be as simple as possible. Flexible conductors and strain insulators may be used for the bus bars and connections in these outdoor substations, but the tendency appears to be rather in the direction of using self-supporting copper or iron tubes mounted on pillar insulators. The transformers and oil switches may generally, with advantage, be supported on separate steel structures alongside the bus bars. These structures would be provided with strain insulators to take the pull of the line conductors. The air-break disconnecting switches would, of course, be mounted on the main bus-bar structure.

Outdoor substations of capacities up to 20,000 kw. have been erected and are giving entire satisfaction. These stations naturally cost less than the indoor substation requiring a large building to house the transformers and high-tension switchgear. A reduction of at least 20% in cost may generally be realized. Outdoor substations appear to be essentially an American development. Very few are to be found in Europe; but this may be accounted for partly by the greater distances of transmission and higher voltages on this side of the Atlantic.

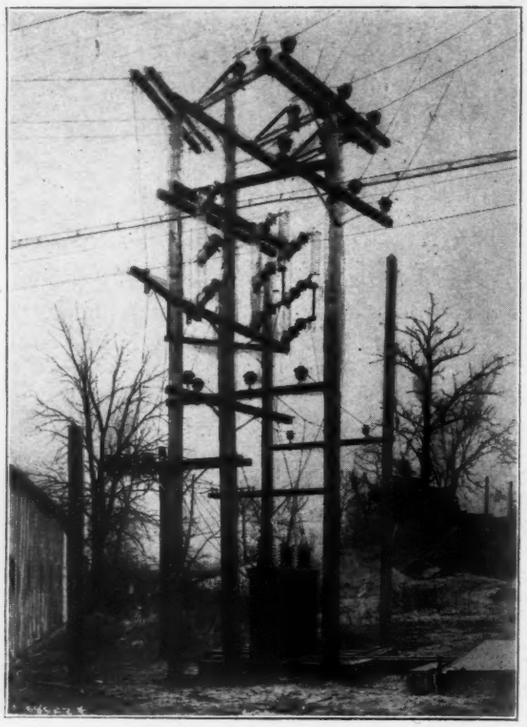
Possibilities of Automatic Substations.

In addition to the substations on high-tension systems, which are usually transforming stations or switching stations (at the junction of lines), or a combination of both, the substation with revolving machinery has also received a great deal of attention lately. The increasing scales of wages and the shortening of the hours of work

*Preceding articles of this series appeared in the issues of July 17, Aug. 7 and Aug. 21.



Outdoor Switching Station at Junction of 66000-Volt Transmission Lines of Texas Power & Light Co.



Typical Installation of Small Substation (75 Kv-a.) on 33,000-Volt Line.

have led to a great deal of attention being given to the possibilities of automatic substations to operate without attendants, except for periodic inspection and maintenance. Substations are established when the distances from the centers of distribution are such that it would be uneconomical to transmit the energy over feeders of the capacity required to give the proper regulation.

Obviously substations may be required to fulfill various functions, as, for instance, to convert alternating current into continuous current, or to change either the voltage or frequency of an alternating-current system. Revolving machinery is necessary not only in the alternating to continuous-current substations (synchronous-converters or motor-generators) but also in the frequency-changing stations (motor-generators).

The object of the automatic substation is to start, regulate and stop this rotating machinery as and when required without the necessity of someone being in attendance on the spot.

It is only within the last five or six years that engineers have given serious thought to the possibilities of automatically controlled substations, but a large number of automatic and semi-automatic substations are now in operation, especially in connection with electric railroad systems. At first no attempt was made to control in this manner machines much larger than 500 kw. in capacity, but synchronous converters of 1000 kw. and even as large as 2000 kw. are now being operated automatically. The main problem in connection with the automatic control of very large converting units is the design of reliable contactors where very heavy currents are involved.

The direct-current machinery in an automatic substation is operated generally as follows:

Pilot wires from the feeding points of the direct-current system actuate relays which start the rotary converters when the voltage falls below a certain minimum. The sequence of operations or the exact manner in which the operation is performed will not be discussed here, but everything is done in proper sequence, as, for instance, the closing of the field exciting circuit only when the speed of the converter has attained a definite value. A polarity relay is also provided in order that the machine shall not be connected to the bus bars with polarity reversed.

Other relays adjust the exciting current until the voltage of the incoming machine slightly exceeds the bus-bar voltage, and when all conditions are as they should be the main direct-current circuit-breakers are closed, usually through resistances which are subsequently short-circuited.

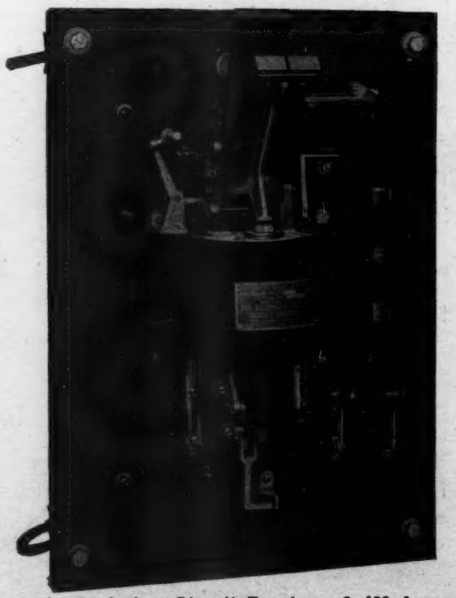
A contact-making ammeter serves to control the load which the incoming machine will pick up. Thermal relays may also be provided to cut out the machine not only when the heating of the windings is excessive, but also in the event of a hot bearing.

Automatic Reclosing Circuit-Breakers.

What are known as service-restoring relays have recently been introduced for the purpose of reclosing circuit-breakers onto feeder circuits after they have been opened.

The type of circuit-breaker made by the Automatic Reclosing Circuit Breaker Co. is shown in the illustration, and the diagram shows the connections for a generator circuit-breaker with automatic resetting reverse-current relay, master-control relay and bearing thermostats to disconnect the machine in the event of overheating of the bearings. These switches are for use on the continuous-current side of motor-generators or rotary-converters.

Automatic reclosing circuit-breakers of this type were first introduced in mines to avoid the necessity of having an attendant at the substation with practically nothing to do but close such circuit-breakers as might occasionally open. The



Automatic Reclosing Circuit-Breaker of 400-Ampere Capacity.

automatic reclosing circuit-breaker makes no attempt to reclose the circuit while the short-circuit or overload conditions remain on the line; this has the advantage over manual operation of saving the generating equipment from the stresses due to throwing on a heavy load suddenly. The operation of these reclosing circuit-breakers has proved to be reliable, and they are now used in substations not only on distributing lines but on main feeders also.

Substations With Synchronous Converters.

What is known as the booster type of synchronous converter is very commonly built to give a range of 230 to 300 volts on the continuous-current side. This is a greater voltage range than is generally needed, but it may be required when—as is sometimes done—power is transmitted over the lines to another substation of the same system.

Improvements in the design of synchronous converters have practically eliminated the commutation troubles which were a serious obstacle to the use of rotary converters on the higher frequencies in the early days of their development. A liability to flash over at the commutator with any sudden change in the load was largely overcome by providing commutating interpoles on these machines as in the modern types of dynamos and direct-current motors.

To provide room for these interpoles and also in order to increase the flashing distance between sets of brushes of opposite polarity, higher peripheral speeds of both armature and commutator were adopted. The most recent proposal in the way of interpole design is to increase the reluctance of the magnetic path, not by adding to the length of the air gap between pole face and armature core, but by inserting some non-magnetic material between the iron pole core and the magnet frame of the machine. By increasing the reluctance of the magnetic path in this manner, it is clearly necessary to put more ampere turns on the commutating poles, but this disadvantage is offset by the fact that armature reaction has less effect upon the flux entering the armature core in the zone of commutation.

Although the 60-cycle synchronous converter no longer suffers from commutation troubles as it did in the early days of its development, it is found that the arrangement of the alternating-current leads from the transformers to the collector rings on the machine is a matter of importance on the larger 60-cycle units. The reason for this is that the large current causes an appreciable reactance voltage drop in the leads unless these are very short. This trouble is naturally less serious in the case of 25-cycle converters. By starting the rotaries by means of star-delta switching devices on the high-tension side of the tranformers, switches on the low-tension side are eliminated and this permits of shortening the alternating-current leads which carry the heavy currents and cause the reactive voltage drop. This method of operation is being tried out, apparently with success.

In order to afford some protection to the converter in the event of disturbances on the continuous-current side, it is customary to insert resistances in series with the outgoing feeders, especially in the case of 60-cycle converters. On 25-cycle systems these resistances are frequently omitted. The resistances must not be so great as to affect the efficiency appreciably and they should preferably not limit the short-circuit current to less than about five times the full-load current of the machine.

Substations with continuous-current machinery and electrically operated switchgear should preferably be provided with a storage battery for actuating the control mechanism.

A lesson learned from a large number of shut-

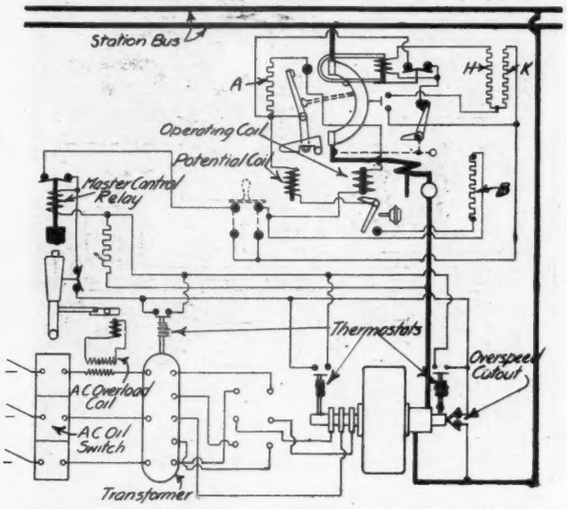


Diagram of Connections of Circuit-Breaker with Automatic Reset Reverse-Current Relay, Master-Control Relay and Bearing Thermostats.

downs on direct-current substations is that even when the majority of the machines in a substation are arranged for starting up on the direct-current side, there should always be one machine at least arranged for starting on the alternating-current side.

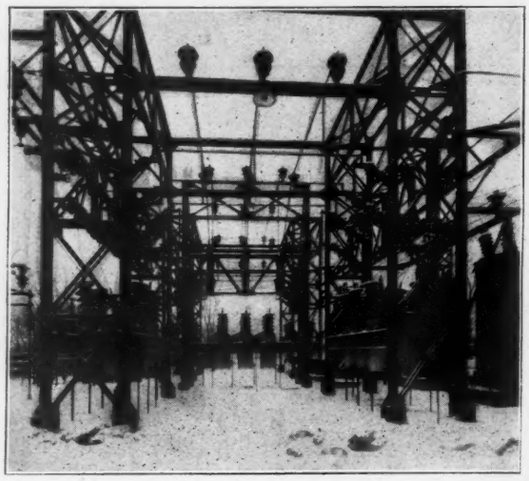
Pole Equipment for Lines in Farming Districts.

One direction in which development is likely to be rapid in the near future is in providing the farmer with electric light and electrically driven machinery. Much has to be done, however, not only in the matter of educating the farmer and getting him to realize the advantages to be derived from an investment in substantially erected branch lines from which electric service may be obtained, but also in avoiding cheap and badly constructed rural lines leading to poor service and ultimate injury to the industry. In this connection there does seem to be a movement toward the standardization of substantial and reliable switchgear and protective devices for use on these small secondary systems, together with a demand for high-class line construction.

Voltage and Frequency for Farmers' Lines.

Whether copper conductors should be used, or the cheaper copper-clad steel, or even galvanized iron, is a matter to be very carefully considered in each instance. The decision will depend largely upon the distance of transmission, and also upon the probable load and the voltage, which will determine the current in the conductors. It is clearly very important that the initial cost of such lines be as small as possible, but never at

the sacrifice of sound engineering construction and reliability of service. The most promising means of attaining the desired end is by further standardization not only of the equipment in the matter of switches, fuses, lightning arresters, choke coils and transformer sizes but also in the matter of frequencies and voltages. At present both 13,200 and 33,000 are very common voltages; but there are many lower and intermediate



70,000-Volt Substation, Showing Oil Circuit-Breakers, Air-Break Disconnecting Switches and Bus Supports.

values used on these small rural systems. The pressure of 16,500 volts, which we are inclined to think of as obsolete, is still in use in some places; also 22,000 volts which, however, seems to be going out of favor. By planning all new lines for a definite frequency and two, or at the most three, recognized standard voltages, the manufacturer would be in a position to cheapen his products and also enable replacements to be more easily made in the event of a breakdown.

Although the overhead guard wire is not now considered of great value on the large high-voltage transmission lines, it seems to be of undoubted protective value on the smaller low-voltage systems. A single No. 6 Siemens-Martin steel wire appears to be satisfactory for use as a grounded guard wire in connection with the farmer lines and small low-voltage transmissions.

Developments in Outdoor Switching and Protective Equipment.

Oil switches and circuit-breakers are in very general use in generating stations and covered substations on the high-tension side of the system.

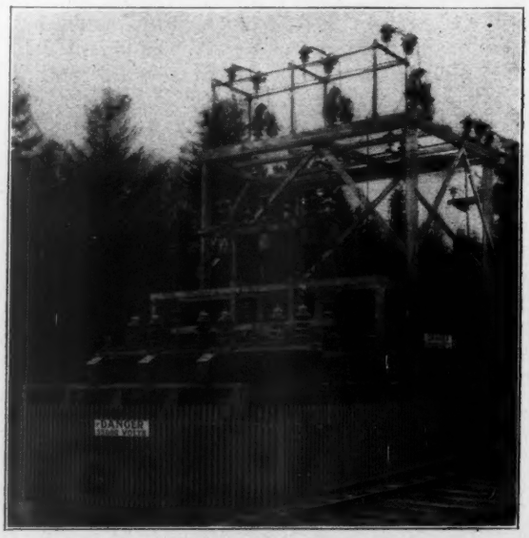
Air-break switches are used on poles and outdoor switching stations on the high-tension circuits; but outdoor oil-break switchgear will probably be used more generally in the future than at the present time. There are no insurmountable engineering difficulties in the way of designing satisfactory oil-break switches for use out of doors, even on the high-voltage lines.

The current-carrying capacity of circuit-breakers depends upon the voltage. The Condit Electrical Manufacturing Co. carries a standard line of oil circuit-breakers for currents up to 7000 amperes on 600 volts on single units, but considerably smaller currents, depending upon the requirements, for higher pressures in the neighborhood of 70,000 volts. The same company makes air circuit-breakers for currents as high as 8000 amperes at 650 volts, these being, of course, of the type generally used in power stations and large covered substations.

The outdoor air-break switch will undoubtedly hold its own in competition with the oil switch mainly because of the higher cost of the latter type, especially when the pressure exceeds about 33,000 volts. On the other hand, the oil-break switch has certain advantages over the air-break switch for the lower voltages. One of these is the fact that the circuit is usually interrupted at the instant when the current is passing through zero value, and that surges are not so easily set up in the system as when an arc is drawn out as in the air-break type of switch.

It is sometimes difficult to realize that the engineer appears today to be able to deal more effectively with high pressures than with large currents. The disturbances that are set up by switching operations or by power arcs following a lightning discharge will be far more serious when the current is large than when it is small. This is one reason why extra-high-tension transmissions suffer less from lightning disturbances than moderate voltage systems on which the current is often larger. It is hardly an exaggeration to say that the handling of heavy currents on long-distance transmissions presents more engineering difficulties than insulation problems on the high-voltage schemes.

At the instant a short-circuit occurs on a large generating plant the current is limited only by the impedance of the circuit, but in a very short time the armature reaction comes into play and the short-circuit current decreases. That is one reason for delaying the opening of circuit-breakers by means of time relays; but nevertheless there is always the danger of heating troubles if a heavy overload is not disconnected almost immediately after it occurs. The proper time setting of overload relays in the different parts of a large system is a problem in itself which has not always received the amount of attention it deserves. A large number of factors enter into the determination of the current under short-circuit conditions. These include not only the voltage



55,000-Volt, Single-Phase Transformers in Service in Lines of Olympia (Wash.) Power Co.

and frequency of the generators themselves, but also the characteristics of the conductors and transformers through which the energy must pass to the point where the short-circuit occurs. Even the magnitude and power-factor of the load being carried and the instantaneous voltage at the instant the short-circuit occurs will have considerable bearing upon the amount of the short-circuit current.

A circuit-breaker will not carry a heavy overload current for any considerable length of time without overheating, and this fact must also be taken into account in the time setting of the tripping relays. Manufacturers should always be prepared to state not only the maximum current-interrupting capacity of a circuit-breaker, but also how long a time the contacts will be able to carry this current without destructive overheating. It is perhaps unfortunate that in many switch designs the enormous mechanical forces which come into play due to the strong magnetic fields set up by abnormally large currents should tend to *reduce* the pressure at the contacts and so decrease their current-carrying capacity just at the time when the highest conductivity is required of them.

Although it is customary to operate sectionalizing and disconnecting switches only when the current is very small, it is sometimes necessary to interrupt currents of appreciable magnitude on high-tension circuits. A very large opening is then required in order to rupture the arc which occurs when the break is in air. In the Burke horn-gap switches the principle of the well-known horn-gap arrester is made use of in drawing out and finally breaking the arc which may form on opening the switch. The stationary part of the switch consists of an insulator on which is mounted one horn of the horn-gap attachment. The rotating member, operated by a grounded handle which may be brought down to within easy reach of the operator, consists of the switch-arm proper and the movable portion of the horn gap. The main contact is completely covered by a sleet hood and protected from any possibility of burning by the arc drawn out between the arcing horns. These switches have withstood very severe tests and have broken repeatedly a dead short-circuit on a 6000-kw. bank of transformers at 44,000 volts with a generator capacity of 74,000 kw. feeding into the short-circuit.

Disconnecting switches for high-voltage transmission lines necessarily occupy a considerable amount of space and for this reason should preferably be erected out of doors. The accompanying illustration, supplied by the Electrical Engineers Equipment Co., Chicago, shows a disconnecting switch and fuse for use on a 110,000-volt circuit. A unit of this type is generally connected in series with an oil-break switch. A feature of this and other switches made by the same company is a patent locking device which effectively prevents the switch blade coming out of the contacts until a pull on the switch hook inserted in the ring at the ends of the switch arm unlocks the device. It is in the evolution of such devices and the careful attention which is being paid to details of design and construction that progress is constantly being made in the reliability of auxiliary apparatus for the distribution and control of electrical energy. The tendency at present is all toward ruggedness of construction and the avoidance of unnecessary complication.

The same company has been devoting special attention of late to the production of standard farm-line switching and protective devices of a simple yet efficient and reliable type. The illustration shows a single-pole set suitable for 13,200-volt service. This equipment consists of

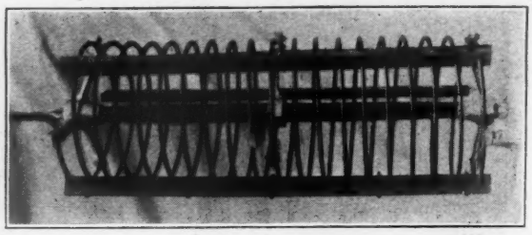
110,000-Volt Hand-Operated Disconnecting Switch and Fuse.

sphere-gap lightning arrester with resistance in ground connection, choke coil, and switch-fuse for disconnecting the transformer from the line. A still simpler type of sphere arrester is also illustrated. It has the diverging wires for breaking the arc forming part of the sphere gap instead of being mounted separately above. The resistance for the ground connection is in the short cylinder immediately below the protecting cast-iron hood. This type is made for pressures up to 22,000 volts, but the photograph illustrates the 6600-volt size.

Fuses and Choke Coils.

Fuses are not usually regarded as satisfactory or reliable for use on high-tension circuits transmitting large amounts of energy. But where the total amount of energy to be interrupted is not excessive there are fuses now on the market which fulfill the requirements successfully. These requirements include opening the circuit without destructive arcing or damage to neighboring apparatus, and performing this duty quickly before the circuit-breakers on the main system have time to operate. The expulsion type of high-tension fuse appears to be quite satisfactory on 15,000-volt service with currents in the neighborhood of 25 amperes. They will interrupt larger currents on the lower voltage systems. The carbon tetrachloride (Schweitzer & Conrad) fuse

has certain distinctive features which adapt it particularly for the protection of high-voltage circuits. A glass tube contains a spiral spring, the lower end of which is connected to the bottom ferrule. The upper end of the spring connects to the fuse wire passing through a cork, the upper end of the fuse wire being connected to a short wire soldered to the cap on the top ferrule. At the top of the spiral spring and just



Typical Form of Choke Coil.

below the cork is a funnel-shaped liquid directer. The glass tube is filled with a non-inflammable liquid of extremely high dielectric strength. This liquid is not only non-inflammable, but it has effective fire-extinguishing properties. The melting of the fuse wire releases the spiral spring which contracts instantaneously, drawing the fuse wire down toward the bottom of the tube and thus introducing a very large gap. Simultaneously with the introduction of this gap the liquid extinguishes the arc and interrupts the current flow, the rapidity of its action being accelerated by the liquid directer which is drawn down with the spring and so forces the liquid directly onto the moving terminal. The action of the tetrachloride fuse is very rapid. Oscillograph records show that short-circuits are interrupted in less than 0.03 sec. These fuses are in use at the present time for currents up to 400 amperes on 7500-volt circuits, and up to 10 amperes on 110,000-volt systems. They are supplied up to 200 amperes capacity on systems operating at 33,000 volts.

Mechanical Construction of Choke Coils.

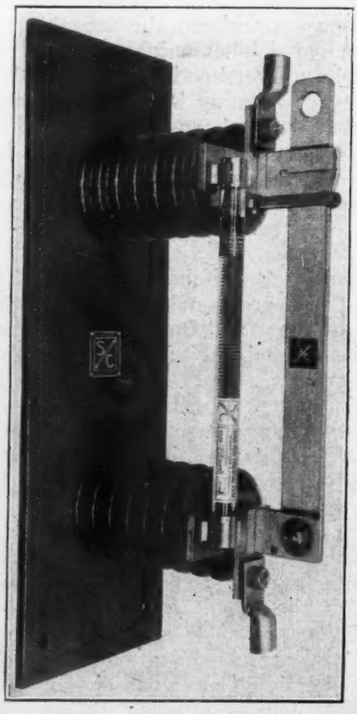
When a lightning arrester is connected between line and ground for the purpose of providing a path to ground for high-frequency surges, an inductive reactance or choke coil is placed in series with the apparatus to be protected. This reactance must not be so great as to cause a serious drop in pressure when carrying the normal line current, neither must it be so small as to allow the induced charges traveling along the line to pass through it rather than jump the air gap of the lightning arrester. This reactance usually takes the form of an air-insulated coil of copper wire or rod, supported at each end on a suitable insulator. Too little attention has been given in the past to the proper design and proportioning of choke coils for use in conjunction with lightning arresters.

It has sometimes been argued that, except for the drop of pressure under working conditions and the higher cost, there is no objection to installing very large choke coils having a high inductance. This argument is, however, incorrect, except for the special case in which some protection against surges is provided on the machine side of the reactance in addition to the lightning arresters on the line side. A high reactance may be quite satisfactory if it is merely intended to hold back high-frequency currents traveling along the line; but surges may originate near the generators or transformers due to switching operations or other causes, and a very high reactance between the electrical plant and the line will tend to aggravate the effect of compartaively low-frequency surges which might otherwise be dissipated in the line, or even through the lightning arrester. In fact, choke coils should be designed with due regard to the apparatus they are intended to protect, with a view to avoiding the building up of high voltages at the terminals of the generating plant in the event of surges being set up in or near the plant itself.

Attention has been paid lately to the mechanical construction of choke coils for use with lightning arresters. It is claimed that the "hour glass" form of coil, in which the diameter of the turns increases from the center toward both ends, is mechanically stiffer than a cylindrical coil; but on the other hand the cylindrical coil may be made in such a manner that it is self supporting and mechanically strong. A self-supporting choke coil which may be strung in series with the connecting wires is made by the Electrical Engineers Equipment Co. and shown in the accompanying illustration. A certain saving in copper is possible with the "hour glass" shape of coil because it incloses more magnetic flux per foot of wire than the cylindrical shaped coil, but the latter is easier to construct and appears to be more generally used.

Lightning Arresters.

The subject of protective equipment generally will be taken up in a succeeding article, and nothing more will be attempted here than to indicate modern trend in the matter of lightning protection.



25,000 Volt Disconnecting Switch Showing Safety Fuse and Locking Device.

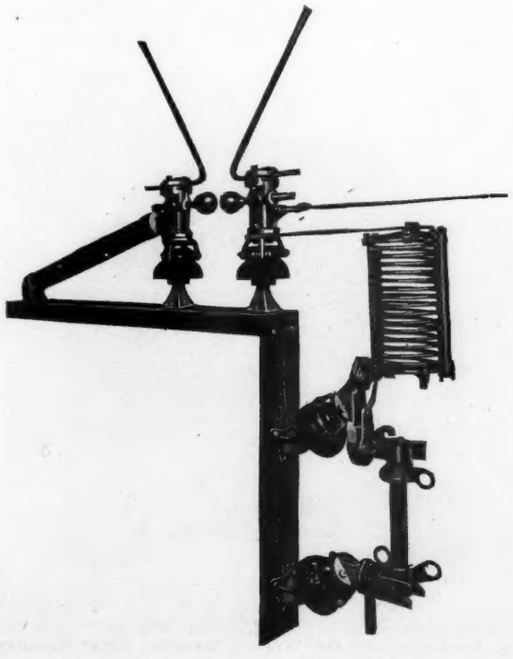
An air gap between ground and the circuit to be protected against over-voltage would seem to be a simple way of relieving a system of abnormally high pressures. This will usually be satisfactory for voltages below 1000, but for 2000 volts and upward a power arc is liable to follow the discharge, especially when fed by a power station of large capacity.

A resistance in series with the gap is an improvement if the resistance has not too high a value, or a fuse or circuit-breaker may be inserted to interrupt the power arc. The multiple-gap arrester, especially when arranged with properly disposed resistance shunting a certain number of the series gaps, has many advantages over the single-gap. The compression-chamber arrester is a special form of multi-gap arrester with the parts inclosed in a sealed porcelain tube. The heat of the discharge produces a pressure inside the tube which is helpful in extinguishing the arc. These are all types which give good service on systems operating at low and medium pressures.

For the highest voltage systems, the aluminum-cell arrester has proved to be very effective. It is not, however, without its disadvantages, one of these being the necessity of "charging" it periodically—about every 24 hours. It also requires a gap in series, because there would be some loss of energy and resulting rise of temperature if left continuously in circuit. This gap has the objection of all spark-gap devices that it introduces the risk of setting up surges or pressure rises in the system.

A recent development is the oxide-film arrester which has no liquid electrolyte between the electrodes of the cells and does not require periodic "charging." It appears to be gaining favor and is giving good service.

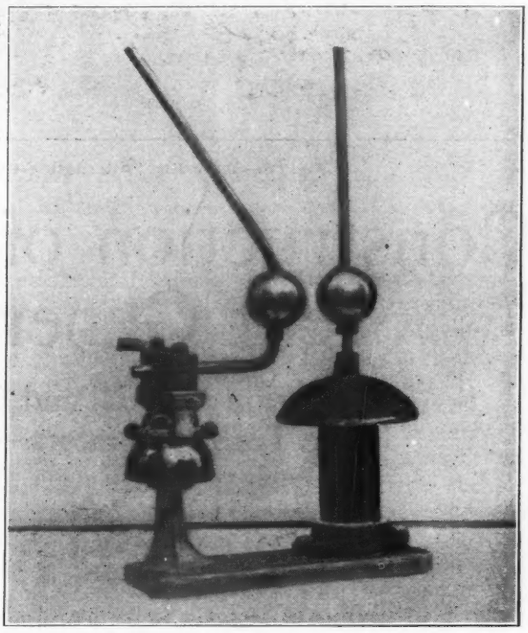
The horn-gap arrester and the sphere gap with flaring horns to extinguish the arc are not used to so great an extent here as in other countries. It is true that this type of arrester has the disadvantage of occasionally causing dangerous pressure rises on the system, but when scientifically designed with resistances or grouped with other units having different gap settings, very satisfactory results may be obtained with it.



Farm-Line Switching Equipment for 13,200-Volt Service.

Types of Protective Apparatus Used in Europe.

In Europe there is somewhat more variety in the matter of protective apparatus than in this country. Each system is carefully studied as a special problem and protective apparatus provided accordingly. Electrolytic arresters are not used to any great extent, but this may be partly accounted for by the fact that the pressures are generally not so high as in America, owing to the shorter distances of transmission. The multiple-gap arresters with non-arcing cylinders of the Wurts type appear to be giving satisfaction abroad on the medium-voltage schemes.



Sphere-Gap Arrester for 6600-Volt Lines; Also Made for Lines up to 22,000 Volts.

Static condensers and water-jet arresters are frequently employed by European engineers. The Moscicki condenser is intended to afford a path to ground for high frequency disturbance while passing only a negligible amount of current on the normal frequency of the system. The water jet, connecting the line to ground through a thin column of water, is also intended to relieve the line of "static." These fulfill their function satisfactorily, but they nevertheless have fairly obvious disadvantages. It has been suggested that the study of protection against lightning has not been carried so far in Europe as in this country, but it should not be overlooked that the last word has by no means been said in the matter of protection against abnormal pressure disturbances, and the European engineers, having more choice of selection, are perhaps quite rightly still experimenting with a view not so much to crystallize practice as to determine how the best possible protection may be afforded when the special conditions of operation have been thoroughly studied.

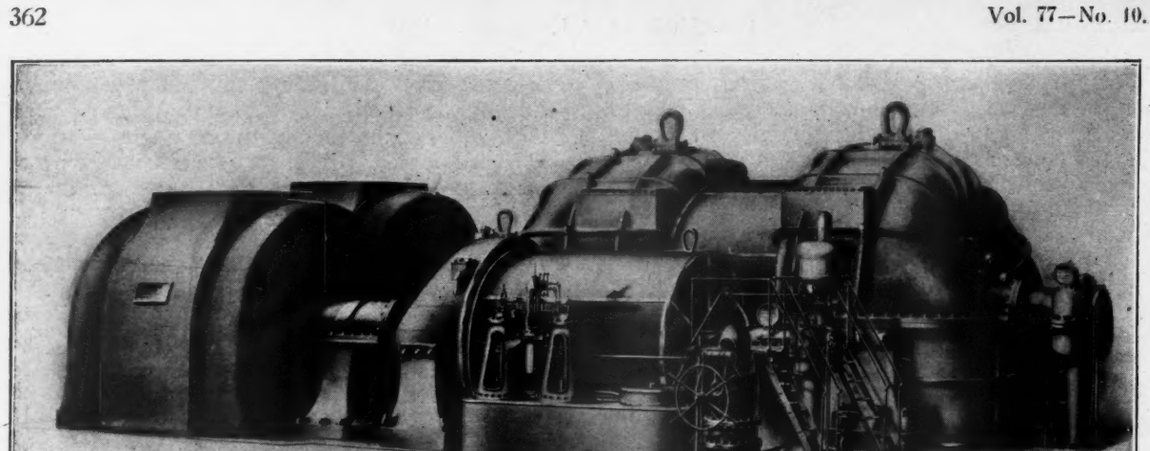


Fig. 1.—30,000-Kw. Alternating-Current Generator with Axial Ventilation.

Construction of Alternating-Current Generators—Part I.

Discussion of Axial and Radial Methods of Ventilating Large Turbogenerators—Comparison of Two Methods —Description of Externally and Internally Driven Fans

By S. L. HENDERSON

Power Engineering Department, Westinghouse Electric & Manufacturing Co.

Alternators for direct connection to turbines may be classified according to the type of ventilation and according to the type of rotor construction; that is, the machine may be axially ventilated or it may be radially or air-gap ventilated and it may have a parallel-slot rotor or a radial-slot rotor.

Axially Ventilated Turbogenerators.

In axially ventilated generators the air is taken through both end bells, after having passed through suitably arranged ducts. The air is then free to pass through or around the end windings of the stator coils and then into vent ducts in the stator core parallel to the axis, through which it flows from both ends toward the middle of the frame. It then enters two or more radial vent ducts and is discharged radially outward to a chamber inside the cast-iron frame, from which it either passes directly outward from the frame or flows circumferentially through channels toward the outlet. In parallel with the paths for the air through the axial ducts in the stator punchings, air may pass axially through the air gap, and, when suitable provision is provided therefore, through axial ducts in the rotor, which will be subsequently described. The air which emerges from the rotor joins the air passing through the air gap, and both are finally discharged into the central radial vent ducts in the stator, where it unites with the air which is passed through the axial vents in the stator punchings.

The smaller sizes are provided with holes at the bottom of the frame for downward discharge. The larger frames are provided with chimneys at the top and bottom, either of which may be closed according to the requirements. The discharged air passes to the room or is conducted through a suitably arranged duct to some other locality.

The axial ducts in the stator core in one of the small frames are shown in Fig. 2. It will be seen that there is a circle of holes immediately behind the slots, and a second circle of holes sit-

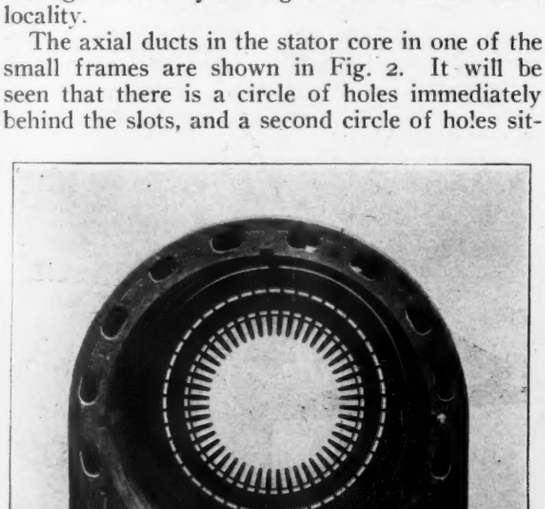


Fig. 2.—Turbogenerator Frame, Showing Axial Ventilating Ducts.

uated about half way between the backs of the slots and outer periphery of the core.

Fig. 3 shows an end bell with an inner wall. such as is used in conjunction with an internal centrifugal fan. The air enters the end bell near the bottom of the machine between the inner and outer bell and is discharged by the fan into the inner bell. The pressure is built up within the inside of the inner wall. Fig. 4 shows a stator punching of a large 25-cycle, two-pole generator, the holes for axial vent ducts appearing plainly. Fig 5 shows (1) a stator frame with chimney at top and bottom; (2) some of the holes through which the air enters the stator and plates (and then the axial vents in the stator punchings), which appear just to the right of the right-hand portion of the stator winding; and (3) a part of the inner portion of the central vent duct, into which the air passes from the air gap, as well as from the axial vents in the stator punchings.

Radially or Air-Gap Ventilated Turbogenerators.

With radial or air-gap ventilation, the air passes axially through the air gap after having entered the end bells, and then flows radially outward through the radial vent ducts which are usually spaced uniformly the entire length of the core. After emerging from the stator punchings the air passes into the stator frame, from which it is discharged downward or upward in the same manner as in the small axially ventilated turbogenerators.

Fig. 6 shows details of radial type ventilation; (1) in the upper left-hand part of the illustration is a stator punching with vent spacers attached; (2) in the upper right-hand corner is a stator punching without vent fingers; (3) in the lower part is a stator punching with clamping fingers.

In most of the radially ventilated turbogenerators the end bells are provided with one wall only, since centrifugal fans are not generally used. Instead, air-gap blowers are fastened at the ends of the rotor body, their tips running close to the ends of the straight parts of the stator windings, as shown in Fig. 7. In a few frames, built for radial ventilation, centrifugal fans are employed, which build up a sufficient pressure within the inner walls to drive the air through the air-gap and radial vents. At times both air-gap and centrifugal blowers are used. The air-gap fan has vanes which are included at an angle of about 45 deg. with a radial plane. Each rotor is provided with left-hand and right-hand air-gap fans, which act as scoops and drive the air axially along the surface of the rotor. The foregoing description of radial ventilation pertains to those turbogenerators with smooth cylindrical rotors.

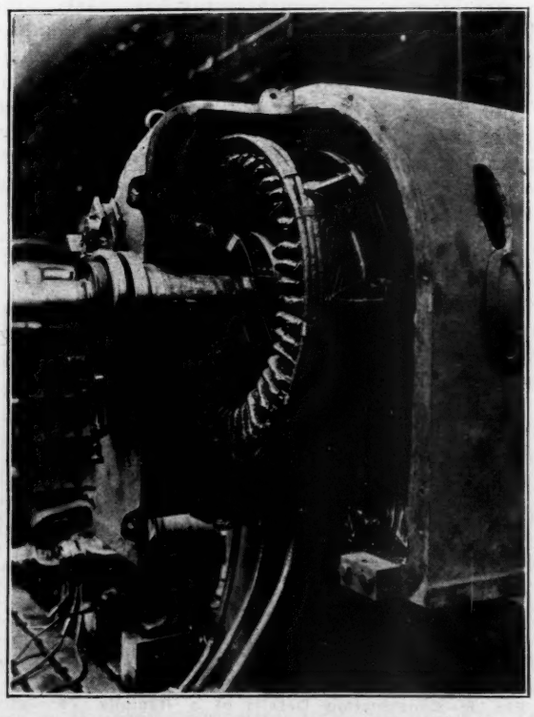


Fig. 3.—Turbogenerator, Showing End Bell with an Inner Wall.

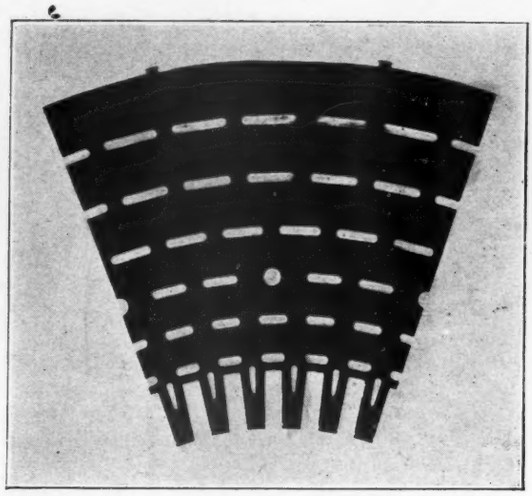


Fig. 4.—Stator Punching, Showing Axial Ventilating Ducts.

Comparison of Methods of Ventilation.

The radial type of ventilation was generally used by the Westinghouse company for many years, the principal change having been in the type of fan employed. The demand for larger units, however, carried with it a requirement for considerably larger volume of air, in order to maintain reasonably low temperatures in a stator core winding. The air gap was not of sufficient size to permit the flow of as great a volume of air as was then needed, unless accompanied by not inconsiderable sacrifices in some other proportions. The axial ventilating method was then adopted which employs a large number of air paths in parallel with the air gap.

Axial ventilation tends to obtain a more uniform temperature throughout the stator core than does radial or other forms of ventilation which have been investigated. Axial ventilation was adopted in the smallest machines, not only because of these advantages but also because the stator teeth are then so narrow that sufficient area for the air can be provided only with difficulty in case radial ventilation is adopted. In large machines, with the radial type of ventilation, sufficient air can be forced through the machine only at great velocities in the air gap, and these high velocities necessitate great pressure.

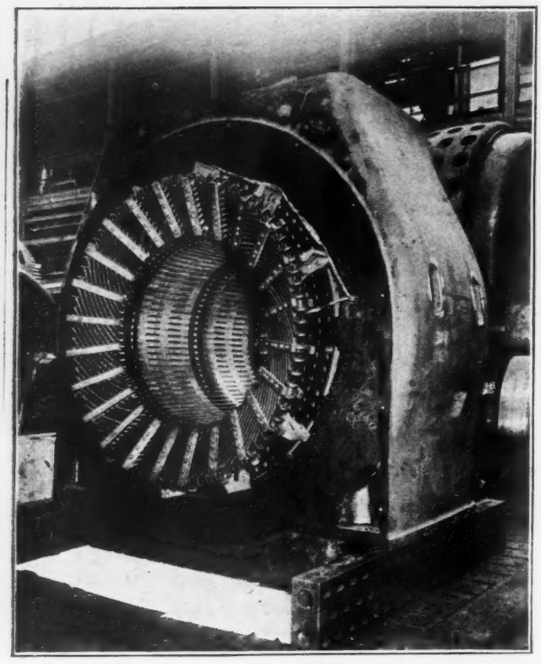


Fig. 5.—Stator Frame of a Turbogenerator.

They are accompanied by large energy losses, which are in themselves of sufficient magnitude to produce a not inconsiderable rise in temperature before the air is useful in cooling the stator and rotor.

Internal and External Fans for Ventilation Purposes.

When fans are on the same shaft with the rotor, as has been indicated above, they are of necessity of high peripheral speed, and are more or less restricted in area. That is, the type of blower that would economically operate at these peripheral speeds would be one which would generate a high pressure of air, and usually with low volume (since the area is restricted). The turbogenerator does not need high pressure, but it does need large volume.

On the small and medium size frames a design with fans mounted directly on the rotor shaft at each end of the rotor does not prove to be a very serious handicap. For some installations of turbogenerators it has been found preferable to omit these fans on the shaft and to employ separately driven, relatively low-speed fans from which air may be conducted through suitable ducts to the end bells of the generator. The end bells then have only one wall. With these separately driven fans there is the additional advantage that the rotor is shorter and therefore stiffer. Consequently, there is less tendency to vibrate. Furthermore, the losses in the slow-speed fan are somewhat lower than in the high-speed fan and therefore the initial temperature of the air entering the alternator is correspondingly reduced. The external fans are driven direct by an induction or direct-current motor, as may be desired. They are designed to provide the volume of air required per minute at the pressure needed in the end bells, plus an allowance for some drop in the air temperature. They should be placed in the power house as close as possible to the generator so as to reduce to a minimum the drop in pressure.

The externally driven fan necessitates an additional auxiliary in the power house and for this reason it is very advantageous to provide for fans mounted directly on the rotor shaft, despite the inherent disadvantages of this construction. Some designs, including those for the largest capacity machines, provide for fans mounted directly on the rotor shaft.

Whether an internal or external fan is used the intake ducts to the fans should be short. They should have as few bends as possible, and such bends as are adopted should have an inner radius not less than three-fourths the width of the channel. The air velocity should, if possible, be kept below 2400 ft. per min. The ducts should be reasonably smooth on the inside so as to minimize friction loss. If the above precautions are followed, the drop in pressure in the air ducts will seldom exceed 1.03 ins. of water.

With air initially at 25 deg. and with a barometric pressure of 30 ins. of mercury (the weight of air is then 0.074 lbs. per cu. ft.) there is a temperature rise in the air of 18 deg. C. if there is an allowance of 100 cu. ft. of air per min. for each kilowatt loss.

In the larger units temperature rises of the air of 22 to 27 deg. C. are obtained. Even so, the problem of handling the large volumes of air becomes a difficult one.

WESTINGHOUSE EMPLOYES TAKE VOLUNTARY INSURANCE.

Advantage Is Taken by 90% of Employes of Additional Insurance Plan Recently Made Effective by Company.

Over 90% of the employes of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., have taken advantage of the additional insurance of insurance and savings plan recently made effective by the organization. This, in effect, means that nearly all employes have savings accounts, because to be eligible for additional insurance the company requires each worker to deposit a portion of his earnings in the employes' savings fund.

Every employe when completing six months' service with the company is given a $500 life in-

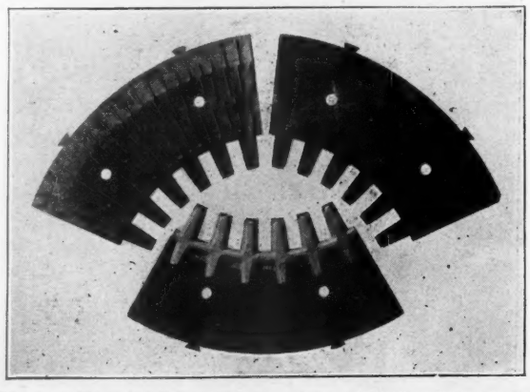


Fig. 6.—Construction Details of a Radially Ventilated Turbogenerator.

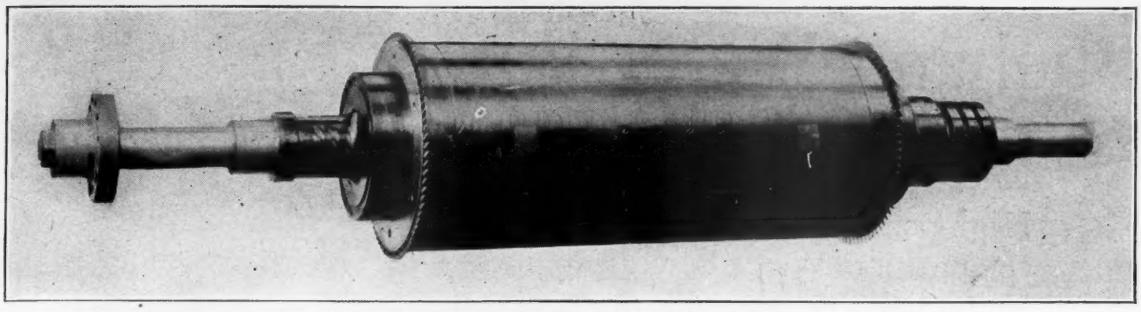


Fig. 7.—Rotor of a Radially Ventilated Turbogenerator, Showing Air-Gap Blowers.

surance policy, free of charge and without any restrictions. By continuing with the company and depositing at least 2% of his earnings in the employes' savings fund, additional insurance of from $500 to $1500 may be secured, the amount depending upon length of service. A policy of from $1000 to $2000 may, therefore, be obtained by every employe of the Westinghouse company depositing in the fund, which pays interest at the rate of 4.5% compounded semi-annually on all deposits.

To assist an employe to meet an emergency loans will be made from the employes' saving fund. Every depositor can borrow 90% of the money he has in the fund without in any way affecting the value of the insurance. Repayment can be made at the rate of 10% monthly.

In addition to paying interest on the deposits, the company guarantees that the fund is not to be used for private enterprise, but is to be held in trust solely for the employe, who can withdraw his savings account with accumulated interest at any time.

The percentage of employes who have opened savings accounts with the company is much higher than has heretofore been obtained by other organizations with insurance plans. It is somewhat unique in industrial annals to know that 90% of the workers in one of the largest organizations in the world have savings accounts, and through their thrift have made themselves eligible for life insurance policies of $1000 and over.

ELECTRICAL SUPPLIES EXPORTED FROM UNITED STATES.

The imports of electrical goods and illuminating supplies into Paraguay amounted to 166,547 pesos ($160,718) in 1919, compared with 67,098 pesos ($64,750) in 1918. Under normal exchange a gold pesos is worth $0.965. Of the total given the United States' share of the trade was valued at 46,235 pesos ($44,617) in 1919, against 14,577 pesos ($14,067) in 1918.

Electrical supplies to the value of $435,771 were imported into Peru during 1918, compared with $664,219 in 1917.

Statistics covering the trade of Hongkong, China, show that the import of electrical machinery fell from $833,245 in 1918 to $488,184 in 1919. In this trade the United States furnished 85% of the whole, with Great Britain 13%, and the rest scattered.

South Australia imported electrical apparatus, etc., to the value of $61,668 for the year ended June 30, 1918, compared with $94,054 for the corresponding period in 1917. Over 85% of the electrical supplies, not including electrical machinery, came from the United States, the United Kingdom furnishing the remainder, although Japan supplied 55% of the covered copper wire.

EXECUTIVE COMMITTEE SELECTED FOR MICHIGAN SECTION.

The members of the executive committee of the Michigan Section of the National Electric Light Association, selected at the recent annual convention at Ottawa Beach, are as follows: W. M. Lewis, Muskegon; H. A. Fee, Adrian; S. B. Tuell, Houghton; R. E. Keller, Kalamazoo, and B. E. Woltz, Ludington. This list differs somewhat from the one previously announced, an error having been made in two of the names. Officers of the section, previously announced, are George E. Lewis, president, Ann Arbor; J. K. Swanson, first vice-president, Jackson; E. Holcomb, second vice-president, Alma, and H. Silvester, secretary and treasurer, Ann Arbor.

EXTENSIVE CONSTRUCTION TO BE MADE BY ALABAMA POWER CO.

Alabama Power Co., Birmingham, is arranging an extensive construction program to include the erection of a number of power plants and extensions to existing generating stations. The immediate work to be carried out includes the erection of a hydroelectric power plant at Judkins Riffle on the Coosa river, to cost about $10,000,000, including station and equipment, dam construction, transmission lines, etc. At Lock No. 12, the company is planning for the erection of an addition to its power plant, aggregating 20,000 hp., and bringing the total generating capacity of the system to 105,000 hp. This latter project is estimated to cost about $500,000.

EFFECT OF FREIGHT RATE INCREASES ON UTILITIES.

The public utility companies will have another item added to the cost of doing business, and that is in the matter of freight increases on coal. The new rates take effect this week, and in the eastern territory the increase is in the neighborhood of 40%, which at 1920 contract figures for coal will add about 14% to fuel prices. To convey some idea of what this increase means, the New York Edison Co. and allied concerns in New York City will be called upon to bear an added expense of $1,302,000, as they consume 1,500,000 tons of coal annually.

Fuel and Water-Power Resources of the United States

High Costs Rather Than Actual Fuel Shortage Necessitate Development of Water-Power Facilities—New Law to Promote Industrial Economy Through Hydroelectric Development

Probably the most significant achievement in the field of American industry in the present industrial readjustment will be the development on a large scale of the nation's vast water-power resources. With the revival of normal industrial activity by the nations of the world, competition in the markets will become increasingly severe. Economy in the application of power to the production and transportation of goods will in large part measure the competitive ability of the various nations. As emphasis is more and more placed upon cheapness of power resources, coal and iron alone henceforth will not be such decisive factors in measuring the potential industrial capacity of nations, and water power will have a new significance as a national asset. It is estimated that the United States has the means for effecting a saving in the matter of its energy supply of well in excess of $1,000,000,000 a year, according to an analysis of the situation made by the Guaranty Trust Co. of New York City. For the most part this saving can be effected only through a fuller utilization of the nation's water-power resources.

The national control of the development and use of water power has been liberalized by the recent Water-Power Act. Already there is under way a survey of the power resources of the Atlantic seaboard between Boston and Washington by the United States Geological Survey under the special direction of Congress. A proposed plan of development in this region is being considered whereby, through the co-ordination of hydroelectric enterprises with steam generation of electricity in the mine fields and at convenient points elsewhere, an estimated saving of $300,000,000 annually is to be effected.

Coal and Oil as Sources of Power.

Almost 700,000,000 tons of coal was produced in the United States during 1918, and this country consumes nearly one-half of the world's entire coal output. The total demand for coal is increasing at the rate of approximately 50,000,000 tons a year. About two-thirds of the coal consumed in this country is for power, divided about equally between the industries and the transportation systems.

TABLE SHOWING NATIONAL COAL RESOURCES AND QUANTITIES USED TO DATE.

Kind of Coal.	Total resources, tons.	Used to date, tons.
Anthracite	19,000,000,000	2,800,000,000
Bituminous	1,500,000,000,000	9,200,000,009
Lignite	2,000,000,000,000	Negligible amount.

That our need for water-power development, however, is a matter of relative economy rather than an actual shortage of solid fuel in the United States is shown by the accompanying table. The United States Geological Survey estimates that there are in Alaska 12,000 sq. mi. of coal fields, of which 1200 sq. mi. are underlaid with coal, the total estimated deposits of these fields amounting to 150,000,000,000 tons. The production of coal in this territory in 1917 was 53,955 tons, and in 1918 it was 75,606 tons.

This country will continue to rely very largely upon anthracite for domestic uses, but there are important possibilities of supplementing natural anthracite with smokeless fuel obtained from bituminous coal and produced by processes which permit the saving and utilization of the valuable by-products. The restricted area in which anthracite is found makes inevitable the continuance of an enormous burden upon the railways in distributing this fuel to the consumer.

It is in the possible reduction of the proportionate reliance of the industries and the transportation systems upon bituminous coal for energy that water-power development promises the greatest economies. Coal alone represents more than one-third of the country's total freight, and much of it has to be carried long distances to supply the requirements of the widely scattered population. The steam railways themselves consume about 160,000,000 tons of coal annually. Under existing conditions of power generation, the greater our progress in manufacturing the greater becomes the burden upon our transportation systems in the way of haulage of fuel.

A way out of the present situation cannot be found through a retention of the wasteful system of isolated steam-power production with a shifting of dependence from coal to petroleum. The United States produced in 1919, in round numbers, 356,000,000 bbls. of petroleum, and the country's consumption is nearly three-fourths of the world's output. While in proportion to bulk oil yields more energy than coal, the limitations of the supply alone would make it inadequate to serve as the chief sources of motive power.

From 1859 to 1917 there was produced in the United States 4,200,000,000 bbls. of petroleum, the supply remaining underground in 1918 being estimated at 7,000,000,000 bbls. At the present rate of production, on the basis of this estimate, our supply would be exhausted within 20 years. But our consumption of petroleum is increasing rapidly, the growing use of automobiles demands an ever greater supply of gasoline, and it is estimated that our merchant marine and navy soon will require not less than 100,00,000 bbls. of fuel oil annually.

Already this country is importing large quantities of petroleum, the total for 1919 amounting

to about 70,000,000 bbls. It is probably safe to say that the world's resources of petroleum have only begun to be exploited, but this fuel cannot be relied upon as the primary source of power.

Water Power an Inexhaustible Source of Energy.

Eventually we shall be compelled to supplement the use of coal and petroleum through the development and utilization of the nation's vast water-power resources. Once installed, hydroelectric plants are operated at comparatively low cost, and the source of the energy, moreover, does not give out. The principal progress in this development promises to be the linking of scattered water powers in comprehensive systems, including the co-ordination of steam-electric with hydroelectric undertakings. Fortunately those regions, generally speaking, which are without coal are best supplied with potential water power. By linking steam generating plants at the mouths of coal mines with hydroelectric plants, great areas may be supplied with power economically.

It is by no means an untried field into which capital is invited by the fuel problem and the liberalization of the national control of water-power development. The growth in water-power installations in recent years, despite many deterrent influences, is suggestive of the progress which it is reasonable to expect in the near future. In 1901, when the federal legislation was enacted under which most of the water-power development of the country has taken place, there was less than 2,000,000 hp. in use. It is estimated that at the beginning of 1920 the development had reached nearly 10,000,000 hp., or one-sixth of the maximum potential resources. The Atlantic states south of New England lead the country in water-power development. Among the individual states New York holds first place with 981,520 hp. developed, California is second with 942,000 hp., and Maine is third with 780,000 hp.

Potential Water Power of the Nation.

Estimates of potential water power vary according to the bases upon which they are made. The maximum flow is taken by the Geological Survey to be that amount the continuance of which for six months of the year may be assured. On this basis the estimated potential water power of the United States is 59,360,000 hp. Another basis used by the Geological Survey is the minimum flow for two consecutive seven-day periods in each year over the period of measurement, and the additional power that may be recovered through the development of available storage capacity in the upper basins of the streams and the use of the stored water to increase the flow in normally low-water periods. Estimates of potential power based upon storage capacity are subject to a wide margin of error, owing to the limited data available. One of the most necessary tasks to be undertaken by the newly created Federal Power Commission is a more comprehensive survey of the whole range of possible water-power development than has hitherto been attempted.

The potential water power of the country, estimated on the basis of the maximum flow as defined above, is given in an accompanying table. The table shows also the undeveloped power, or the total potential power less that already developed. The figures represent the horsepower of the streams at 90% efficiency. In making comparisons of the potential with the developed power it should be noted that estimates of the former are given in terms of continuous, or 24-hr. capacity, while the developed power is given in terms of the installed capacity. The installed capacity is developed in many cases only during a portion of each day. Hence it happens in some states that the developed power, or installed capacity of works constructed, is in excess of the estimated total potential power.

TABLE SHOWING WATER POWERS OF CONTINENTAL UNITED STATES.

	Potential horsepower.	Per cent developed.	Undeveloped horsepower.
New England states..	1,951,000	77.2	444,500
Atlantic states	9,348,000	31.6	6,395,150
Central states	7,360,000	36.7	4,660,800
Mountain states	14,851,000	7.5	13,737,010
Pacific states	25,850,000	6.6	24,299,000
United States	59,360,000	16.6	49,536,460

Generally speaking, more than three-fourths of the potential waterpower of New England has already been developed; in the remainder of the country east of the Rocky mountains roughly one-third is developed, and in the Far West about one-sixteenth is in use. While most of the water power awaiting development is in the Far West, where 68.6% of the potential power is found, the central and eastern states also have immense power resources not yet brought into use. Alaska possesses vast water-power resources which have not as yet been surveyed. It is estimated, however, that there is water power available in such quantity as eventually to assure great industrial development in Alaska. The possibilities of these resources are now being investigated by the United States Geological Survey.

The New Water-Power Law.

Although a good beginning has been made in the development and utilization of the water-power resources of the United States, generally speaking the nation is backward in the matter of applying this form of energy to its needs. There are a number of reasons for this tardiness. Among them are the great volume and the distribution of available fuel, comparatively cheap transportation, the large initial cost of installing hydroelectric works as compared with isolated steam plants, the adverse features of earlier government control over water-power sources, and the lack of a comprehensive plan and policy hitherto for the proper development and co-ordination of the country's natural resources. Before the days of long-distance electric transmission lines, plants using water power had to be located at the power sites regardless of other conditions. Now the range of choice as to location is not so restricted, this factor being of immense economic significance especially for a region already highly industrialized.

The new water-power legislation is in part an outgrowth of changed conditions, and has further stimulated interest in the general problem and possibilities of water-power development in this country. It is believed that it marks the beginning of a new era in this field of enterprise. For

years there has been a strong agitation for a revision of the legislation under which the federal government controls the development of water power on the public domain and in navigable rivers. Although rights to develop water power in national forests, on military reservations and on the public domain not withdrawn from entry are acquired from the states in which the power sites are situated, the federal government is concerned with such enterprises because of the use of these public lands for dams and transmission lines. All navigable streams fall under the control of Congress by reason of the power to regulate commerce and, by implication, the means of commerce between the states and with foreign countries.

Heretofore the privilege of using the national forests or other public lands for water-power development has been conferred by the Department of Agriculture or the Department of the Interior. The privileges have been granted through the issuance of permits for no definite period and revocable at the will of the granting authority. In the case of developments on navigable streams, whether on the public domain or not, each enterprise has required a grant by special act of Congress. These grants could be revoked by Congress at any time, but, unless revoked, the rights were to expire after a period not exceeding 50 years.

Owing to the uncertainty of tenure there has been, as was natural, hesitation to invest capital in such undertakings. It is the purpose of the new water-power act to remove this element of uncertainty and at the same time adequately safeguard the public interest. The law creates a Federal Power Commission composed of the Secretaries of War, Interior and Agriculture. The commission is authorized to issue licenses for works on the public domain, in national forests and on navigable rivers for a period not exceeding 50 years. At the expiration of the license it may be renewed, or a new license may be issued, or the government may take over the enterprise upon compensation of the licensee for the net investment in property used in the generation and transmission of power other than the franchise.

Public-service enterprises are subjected to control of service and rates by state commissions when such exist, and where such a state commission is not in existence the Federal Power Commission is authorized to regulate and control service, rates and the issuance of securities. When the power or any part of it enters into interstate or foreign commerce, the rates and service must be reasonable, just and non-discriminating. Briefly, this involves a degree of control in the field of power development and distribution between states comparable to that exercised over railways by the Interstate Commerce Commission.

Commission to Formulate Rules and Regulations.

Much discretion is left to the commission in the matter of formulating administrative rules and regulations under the act. These are expected to be liberal and in conformity with the general purpose of the law. Guided by the principles of sound business practice, the commission should be able greatly to stimulate the development of the country's water power. The law was signed on June 11, and by the middle of July applications for licenses to develop more than 500,000 hp. had been filed.

The Geological Survey's comprehensive investigation of the power resources of the Atlantic seaboard is in line with this new legislation. For some time there has been under consideration a proposed co-ordinated super-power system covering a zone from Boston to Washington and extending inland 100 to 150 mi. It is proposed to utilize the generating facilities of the power companies already developed or contemplated under existing building programs. In addition the plan calls for the construction of hydroelectric works, particularly on the Susquehanna and Delaware rivers, and steam plants at the anthracite mines. The fact that the federal government has authorized this power survey now under way gives promise that a highly important enterprise in this region is about to be undertaken.

FORWARD POLICY OF BRITISH ELECTRICAL CONCERN.

The General Electric Co., with London office at 67 Queen Victoria street, is one of those successful British industrial concerns which has benefited greatly from the forward policy its management has adopted. This has been particularly the case of late years, and the annual statement recently issued revealed an excellent position. It will be remembered, says *The Empire Mail,* that in March last the company made an important issue of capital, while the accounts now presented cover the year to March 31. A considerable amount of the three millions issued had already been sunk in the business, for the directors state that the company's bankers had advanced a considerable sum, which was repaid out of the new issue last spring. A larger proportion of the advances so employed, however, is not yet productive, and the full effect of the whole of the three millions secured should hardly be seen in the next report. So far as the profit figures are concerned, the results for the past year leave little to be desired. Net profits totalled £630,143, an increase of £149,315 over those for 1918-19, and while the dividend remains at the satisfactory level of 10%, free of tax, the allocation to reserve is raised to £150,000, a grant of £40,000 is made to the superannuation trust fund and the balance forward is then increased by more than £100,000 to a sum of £251,423.

CHAIN STORES TO HANDLE ELECTRICAL GOODS.

Plans have been worked out by the Winchester Repeating Arms Co., New Haven, Conn., for the operation of a chain of retail stores in various sections of the country. Electrical goods, such as heating appliances, washing machines, vacuum cleaners, flash-lamps, flatirons, etc., will be handled in addition to the Winchester and hardware lines at present carried in the several stores established at Boston, New Haven, Troy, N. Y., and Providence, R. I. It is proposed to open retail stores at Norfolk, Jacksonville, Syracuse, Worcester, Fall River, Springfield and Lawrence Mass., and Pawtucket, R. I.

EDITORIAL COMMENT

Business Prosperity

Sound business prosperity is built only on a foundation of confidence. Buyers hesitate or refuse to buy goods in which they lack confidence or in which the manufacturer or retailer lacks full and complete confidence. They also hesitate to order complete requirements in the face of a prospective over-supply or under-demand. Manufactures are loath to prepare stocks in advance when a failing market is in prospect.

Only a lowering of the standards of living can result in a slackening of the actual demands for manufactured goods, and only a speeding up of the individual can result in an over-production. No individual desires a reduction in his living standards and few, in these days, are endeavoring to increase their personal production except to satisfy a new want. All business is founded on the desire of the individual to satisfy his wants for the things that he does not have. Feeling confident that the essentials of existence will be available, the individual turns his attention to the acquisition of some of the conveniences and luxuries of life. One want satisfied always creates a new desire, and business will prosper. The individual will produce in order that he may consume. But if a feeling of confidence is lacking, the individual centers his attention on the essentials and does not buy the conveniences. Only a portion of the available labor is needed to produce the essentials of existence, and, consequently, when confidence fails a large volume of labor is allowed to go unused, savings are dissipated, stocks of goods are used up and business comes to a low level.

Thus, by allowing the growth of a feeling of unrest, an entirely abnormal business situation may be developed. The standards of living are reduced, productive effort is slackened, a portion of the passed progress is lost and the entire country suffers as the result of an entirely useless situation. Materials cannot be produced by idle hands, and idle hands do not earn an income to purchase the stocks of goods already on the market. Unemployment and slackening business, brought on by a lack of confidence, lead to real and serious difficulties that might have been avoided by optimism. Confidence reproduces confidence, but lack of confidence and unrest produce disaster.

Such conditions continue until confidence is restored. With every business man in the country continuously believing in and preaching prosperity there would never be a chance for dull times. Confidence is the secret of success. Believe in yourself, your business, your neighbor and your country, let your confidence be seen and felt by your associates, and you will be one of the contributing factors in the era of prosperity and national development that is just beginning.

Lamp Sockets and Household Appliances

The Society for Electrical Development has called the attention of manufacturers of electrical supplies to the desirability of obliterating the impression in the minds of users that any number of household devices can be attached to one lamp socket by the mere use of branch sockets. This is a desirable move. Lamp sockets are made for a purpose and were in general use before electric ranges, flatirons, washing machines and vacuum cleaners were thought of for household purposes. Having been designed to accommodate incandescent globes and, possibly, electric fans, they, like the wiring systems in many houses, were not intended to be used for supplying large drafts of energy. Even the wiring system in a modern house is not always arranged for the purpose of delivering from one socket the power needed to operate all of the appliances used by the householder.

Although these observations may seem superfluous to the electrically trained man, they are nevertheless important. Common sense, he argues, should restrain any housewife from attaching a washing machine and flatiron to one socket. And, if she should attempt to operate this combination, the only damage that would result would be a blown fuse. This argument is faulty, however, because it neglects the mental attitude of the householder. Besides irritating some person's nature, the improper performance of any piece of domestic electrical apparatus causes her to wonder whether or not it is wise to add any more apparatus to her already improperly performing equipment and trouble to her tortured mind. The wondering person hesitates, the dissatisfied person criticises the equipment, purchases diminish, central stations lose business, and, what is more regrettable than all else, the homes are deprived of the full measure of usefulness of those devices which industry has contrived for the purpose of making domestic life pleasant. All of this is because the user of elec-

tric household devices has not been told how to use them.

There are, of course, numberless books and treatises on wiring rules and formulas that are available for anyone who can read. But one should remember that a book treating of electrical phenomena is about as comprehensible to the technically untrained person as a tablet of Egyptian hieroglyphics. Rules and formulas are of no value if no means of interpreting them exist. There is no use to tell a housewife that a lamp socket will deliver a certain number of power units safely. That means nothing to her. She might and probably would understand the limitations of the fixtures, however, if she were told that the lamp socket would, with safety, supply power for only one flatiron, one fan, or one vacuum cleaner. This is a message that she hasn't received so far. There is no question that the expense involved in delivering it to her would be incurred advantageously to the entire industry.

Business Enterprise Not to Be Called Profiteering

It is a natural law that "trade follows values." Increased business is one of the rewards of improving the quality of goods or of service. These are discriminating times. People are not squandering money thoughtlessly. To be sure, there are some people who are receiving large wages who are not spending carefully, but they are not of the business class and are the ones who will be the first to suffer when financial depression comes.

At the present time there is much talk of profiteering and the punishments which should be meted out to those who have been guilty of profiteering. It is true that a great many have made larger profits than were fair and reasonable, but before any firm, wholesale or manufacturing, is charged with profiteering, the facts should be carefully investigated and no open charges made until such people are found guilty. It is always serious when such charges prove true, but it is time enough then for the guilty to receive their punishment. For a firm to have much talk started about unfair methods before such have been found to be the facts is unjust and un-American.

A case came to notice recently in which articles appeared which criticised a certain firm as a "profiteer." These criticisms were based upon the financial statement of the business of 1919. As this company is a large one, this statement is supposed to set forth facts, and there is no reason to doubt that such is the case.

This particular institution has taken great pains to organize thoroughly so as to keep down the costs of production, at the same time offering to the public a quality article. Simply because "trade follows values," it has never been able to supply the demand for its product, and has refused large amounts of business because it could not be taken care of satisfactorily. When the company felt equal to doing so, "surplus" profits were shared with the workers, and these surplus profits amounted to over $2,000,000. In this way, it avoided unrest, industrial troubles and the expense of idle machinery. Moreover, the company was able to pay a satisfactory wage to its employes, a wage which permitted of thrift and saving.

This firm has been rather harshly criticised for showing such large profits. The reply to this is: "Investigate, not profits but methods by which profits are obtained. Finding fault with industry for making profits, without considering how profit is made, is the height of absurdity, and a 'killing frost' to inventive genius and economical management. What is created by saving is clear gain and costs nothing."

This statement contains considerable food for thought. The government and the people must be exceedingly careful not to kill inventive genius or to do away with the desire on the part of big business to grow and progress. If a firm, large or small, can make a fair profit on a single sale and can multiply this profit by a large number of sales, so as to show net profits of large amounts, it is not profiteering. A profiteer is one who makes an unfair profit on a single transaction, one who gouges or misrepresents.

An honest profit is that which gives a square deal to manufacturer, his workers and consumers. If consumers are given good value and the manufacturers and workers are allowed a reasonable profit because of good business methods, economical manufacturing, correct working conditions and industry which results in big business, then the charge of profiteering is misplaced.

For example, the firm referred to claims that the net profits were 4.88%, but the volume of business made this sum a large one. A net profit of 4.88% surely is conservative, and if such can be shown to be the facts of the case, all charges should be withdrawn and all criticism should be retracted in all fairness. There are always those who are ready to seize upon possibilities of unfair methods and to repeat what somebody has supposed might be the case.

In this period of reconstruction, let us be fair to our fellow business men, and let us throw the weight of our influence on the side of believing every man innocent until he is actually proved guilty. It is a fine opportunity for us to practice the "Golden Rule," and incidentally we will be glad to have other people as fair and as honorable with us.

THE WEEK'S NEWS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

INDIANA ASSOCIATION TO MEET AT FRENCH LICK.

Program Is Replete with Live Subjects Bearing on Public Utilities, Power-Factor, Operating Expenses and Other Problems.

The Indiana Electric Light Association will hold its annual convention at French Lick, Ind., Sept. 15-17. The first session will be opened with the president's address, followed by various committee reports; an address by Martin J. Insull, president of the National Electric Light Association; address by Chairman E. I. Lewis of the Indiana Public Service Commission; address on "Future of Public Utilities" by Charles C. Perry, president of the Indianapolis Light & Heat Co.

The sessions of Sept. 16 will be featured as commercial section day, which will begin with an address on "Voluntary Versus Involuntary Co-operation," by William L. Goodwin; address by Samuel Adams Chase on "Central Stations and Contractors;" paper on "Industrial Application of Electric Power-Factor Correction and Its Effect," by T. F. English, general manager of the Indiana General Service Co.; paper on "Reduced Operating Expenses Versus Increased Fixed Charges" by George A. Neal, Northern Indiana Gas & Electric Co. A round-table discussion will follow, the election of officers closing the program.

EXECUTIVE COMMITTEE OF S. E. D. TO MEET SEPT. 10.

Public 'Utility Welfare and Manufacturers' Advertising Copy Among Subjects to Be Considered at Meeting at Society Headquarters.

A meeting of the executive committee of the Society for Electrical Development has been called for Sept. 10 by the chairman, Charles L. Edgar, at the offices of the society in New York City. J. M. Wakeman, general manager, will report on the result of the communications sent out to manufacturers and others regarding the necessity for informing the public about the proper use of electric appliances and safe-guarding users. Mr. Wakeman also will report on the steps taken to secure the co-operation of daily newspapers throughout the country in efforts to secure sympathetic interest for public utilities in the communities served.

A great deal of interest has been evinced in this subject as well as in the kindred subjects of customer partnership to be attained through the sale of public utility securities to customers. The society has made particular effort to include among the purchasers of securities the public utility employes and others engaged in the electrical industry. Special attention has been given to these subjects in an effort to comply with the decisions arrived at at the July meeting of the executive committee.

The society has received numerous and encouraging responses to the letters sent out recently asking manufacturers to scrutinize more carefully their advertising copy, to refrain from alarming the public unduly, and to refrain from the practice of illustrating in their advertising copy impossible combinations of current-consuming devices on one socket. The last injunction is particularly important because the average householder is not familiar with the demands of household appliances. A proper educational campaign will prevent undeserved criticism of the appliances.

GREAT LAKES DIVISION, N. E. L. A., ORGANIZED.

New Geographic Division Formed by Combining State Associations of Michigan, Indiana, Illinois and Wisconsin.

At a meeting of representatives from the central-station organizations of the states of Michigan, Indiana, Illinois and Wisconsin, held in Chicago Aug. 27, with President Martin J. Insull and Executive Manager M. H. Aylesworth of the National Electric Light Association, plans were completed for the organization of the Great Lakes Division of the N. E. L. A. This is one of the 13 geographic divisions provided for in the reorganization plans of the association approved at the Pasadena convention, the major part of these divisions having already been organized.

Officers elected for the new division are: Chairman, W. C. Lounsbury, Superior (Wis.) Water, Light & Power Co.; vice-chairman, P. H. Palmer, Indiana Railways & Light Co., Kokomo; secretary-treasurer, R. V. Prather, Springfield, Ill. The following were appointed chairmen of the division sections formed: Public relations section, A. C. Marshall, Detroit Edison Co.; commercial section, J. G. Learned, Public Service Co. of Northern Illinois, Chicago; technical section, G. E. Lewis, Detroit Edison Co., Ann Arbor, Mich.

Each state association will appoint three representatives who will constitute the executive committee of the division. Tentative plans were made for a meeting of the geographic division in April of next year.

Besides some of those already mentioned others who attended the organization meeting were: B. F. Lyons, Beloit (Wis.) Water, Gas & Electric Co.; L. N. Boisen, Ashland (Wis.) Light, Power & Street Railway Co.; J. P. Pulliam, secretary of the Wisconsin Electrical Association, Milwaukee; Herbert Silvester, secretary of the Michigan Section, Eastern Michigan Edi-

son Co., Ann Arbor; R. E. Keller, Consumers Power Co., Kalamazoo, Mich.; B. J. Denman, president of the Illinois State Electrical Association, Tri-City Railway & Light Co., Moline, and Frank J. Baker, Public Service Co. of Northern Illinois.

INSTITUTE OFFERS COURSE IN BOILER-ROOM OPERATION.

A course in boiler-room operation is to be offered by the Dunwoody Institute, Minneapolis, Minn., beginning Tuesday evening, Oct. 5. The cost of the course will be $6, which will cover lesson sheets and a text. It will consist of 50 lessons, two to be given each week. In making the above announcement the Dunwoody Institute states:

"It has been found by experience in similar courses that it is essential to prepare most men for a course of this kind by reviewing arithmetic, elementary geometry and elementary algebra. The first ten lessons are therefore of a mathematical nature. The course is intended for men who work in a boiler room, or who are responsible for boiler-room operation. It is desired particularly to have chief engineers and boiler-room foremen enter this course. With the rising costs of coal, the demand for trained boiler-room men has grown so insistent that a course of this kind is essential. The opportunities for economies by more efficient boiler-room methods are in many cases so great that they are astonishing."

EXHIBITS ARRANGED FOR NEW YORK ELECTRICAL SHOW.

Many Applications of Electricity to Industrial and Commercial Activities Will Be Demonstrated by Manufacturers.

A group of manufacturing exhibits has been arranged for the New York Electrical Exposition which will show the important part that electricity plays in the commerce and industry of the country. This display will cover furniture making, factory lighting, baking, laundering, motor repairing, welding, heating, machine-shop equipment, refrigeration, conveyors, electric hoists and freight-handling machinery, electric trucks, and factory wiring.

Some idea of the magnitude of the industrial displays may be gained from the fact that the motors required for the various machines will total more than 500 hp. This is greater than the entire power installation in some factories, and it calls for a special installation of electric wiring. The heating and welding exhibits will be given by the General Electric Co. Lathes, drill pressers, and portable drills will be demonstrated by the Fairbanks Co., in connection with which there will be a factory lighting display by the Western Electric Co. The relation of proper lighting to production will be shown, and charts will indicate the distribution of illumination as effected by different types of shades and reflectors.

The wiring of factories, especially in its relation to safety, will be the subject of a display by the New York State Association of Contractors. The Westinghouse Electric & Manufacturing Co. will show several motor-generator sets, a portable arc welding outfit and will also demonstrate proper factory lighting.

In addition to these industrial displays there will be a very complete exhibit of equipment for the home. Electrotherapeutic apparatus will also be shown and several motor-driven machines for the office will be exhibited.

COAL SUPPLIES OF EASTERN UTILITY COMPANIES.

The various public utility companies in New York City had on hand last week 309,910 tons of coal, an increase of 36,000 tons over the previous week. While this is an important gain, it is still far short of the 400,000 tons which is accounted the normal supply for Sept. 1. On Oct. 1 it is held that the supply should be 800,000 tons in order to avoid danger of a famine during the winter. The New York Edison Co. reported its supply sufficient for 27 days and the Brooklyn Edison for 57 days.

CONSTRUCTION STARTED ON SEATTLE HYDROELECTRIC PLANT.

The construction plant required for building the dam and powerhouse and for the installation of equipment in Seattle's Skagit river hydroelectric project will be under way within the next few months, and will become a permanent auxiliary to the principal plant as soon as the project is completed. Equipment ordered for the construction plant comprises one Westinghouse 2500-kv-a., three-phase, 60-cycle, 6600-volt, two-bearing horizontal generator of the waterwheel type, to be driven by two Pelton overhung impulse wheels, each of 1500-hp. capacity and of a speed rating of 450 r.p.m. Auxiliary equipment is to consist of waterwheel governors, a 30-kw. belted exciter and a four-panel switchboard. The waterwheels will operate under a head of 513 ft.

This equipment is to be installed at a site on Newhalem creek, a tributary of Skagit river. The site is one-half mile from that of the big hydroelectric plant to be built at the mouth of Gorge creek. By the time equipment and material are ready for delivery on the project, the railroad being constructed from Rockport to the project sites will probably be ready for service.

ELECTRIFICATION OF NETHERLANDS RAILWAYS.

For three days the commission of railway experts sent by the government of the Netherlands to this country to study American electrification methods discussed with the engineers of the Westinghouse Electric & Manufacturing Co. questions which will involve the selection of equipment for Holland railways. The commission discussed the electrification of railways in general and in particular the Holland railway problems. It studied both alternating and direct-current systems and made a thorough inspection of the shops in which such locomotives were built.

The president of the commission is L. M. Barnet Lyon, member of the board of control of the Netherland Railways, and J. H. W. Van

Loenen Martinet, chief of electric traction of the Netherland railways, is secretary. The other members are H. J. Van Lessen, chief of electrical development of Holland; H. Doyer, consulting engineer, and W. J. Burgersdijh.

It is said that electrification will be started shortly on the railway connecting Amsterdam, the Hague and Rotterdam, which is about 50 miles in length. The equipment will be largely multiple unit, but some locomotives will be used.

ELECTRICAL EXPORTS SHOW FALLING OFF IN JUNE.

Total Amounts to $9,011,949, a Decrease of $1,980,682 Compared With Same Month Last Year—Yearly Figure Is $87,208,413.

Exports of electrical goods to foreign countries for June were valued at $9,011,949, compared with $10,992,631 for the corresponding period in 1919, or a decrease of $1,980,682. For the 12 months ending June, 1920, the total exports amounted to $87,208,413, or an increase of $6,494,289 over the 1919 figures and of $32,661,452 over the total for the 12 months ending June, 1918.

The above figures are taken from the monthly summary prepared by the United States Bureau of Foreign and Domestic Commerce. The following classified figures give the detailed data for June, 1920, compared with the corresponding month last year:

Electrical machinery and appliances (except locomotives):	June, 1919.	June, 1920.
Batteries	$ 787,748	$ 578,146
Carbons	173,582	113,109
Dynamos and generators	760,546	571,340
Fans	130,817	191,434
Heating and cooking apparatus	192,551	164,344
Insulated wire and cables	1,420,699	593,370
Interior wiring supplies, including fixtures	280,631	270,709
Lamps—		
Arc	173	7,743
Incandescent—		
Carbon filament	5,176	4,518
Metal filament	530,085	364,864
Magnetos, spark plugs, etc	219,826	290,723
Meters and measuring instruments	319,336	237,735
Motors	1,562,521	1,250,638
Rheostats and controllers	65,384	83,504
Switches and accessories	593,975	608,330
Telegraph apparatus, including wireless	92,220	30,458
Telephones	377,395	275,212
Transformers	438,483	402,016
All other	3,041,383	2,973,756
Total electrical machinery, etc.	$10,992,631	$9,011,949

NAME CHAIRMAN OF PROTECTIVE DEVICES COMMITTEE.

In the list of chairmen of committees of the American Institute of Electrical Engineers for the administrative year beginning Aug. 1, 1920, and published in the Aug. 21 issue of ELECTRICAL REVIEW, the appointment of D. W. Roper, Commonwealth Edison Co., Chicago, as chairman of the protective devices committee was inadvertently omitted.

DISCUSS FUTURE OF BRITISH ELECTRICAL INDUSTRY.

At a dinner given by the British Electrical and Allied Manufacturers' Association, Inc., recently, Lord Ampthill presiding, Sir John Snell said that since 1916 no fewer than seven departmental committees had been appointed in connection with the electrical industry. The series of committees practically covered the whole gamut of electrical enterprise. In 1913 the actual sale of electrical units in Great Britain was about 1,300,000,000. In 1919 it had grown to nearly 4,500,000,000. He predicted that in the next 10 years or so there would be such a period of prosperity before the industry as they had not dreamed of before the war. There had been a good deal of talk in the non-technical press, he added, about the sweeping away of the generating stations in that country and superseding them by 16 super-power stations. The experts in the industry knew that any such proposal was utter nonsense. What was required was to weed out the very bad stations, to improve the others, and to add to these as, and when required, large and complementary capital stations which would meet the needs of various districts which were crying out for the supply of electric power.

ELECTRIC FURNACE ASSOCIATION TO MEET IN COLUMBUS.

The subject of refractories has been selected for the meeting of the Electric Furnace Association to be held Oct. 6 in Columbus, O. The session will provide an opportunity for a discussion of their problems by the users and makers of refractories. Steel men, brick and lining-material manufacturers will submit papers, and time will be allowed for questions and informal discussion. The association plans to hold its session in one of the buildings of the Ohio State University.

SERVICE ORDER NO. 9 MODIFIED BY COMMISSION.

Substance of Modification Is That Public Utility Companies Can Secure Coal for Storage Purposes.

The executive office of the National Electric Light Association has obtained a modification of I. C. C. service order No. 9 that will bring relief to a great many central-station operatives. Under the original ruling, public utilities were given priority of cars for coal for current needs. It happened that several utilities had a small reserve supply when the order was issued and were able to obtain a small amount of coal for reserve by purchasing in the open market. In making applications to the railroads for cars, the utility concerns were compelled to stipulate the amount of coal on hand. When this stipulated amount was more than enough for current needs, the railroads refused to allot cars. This refusal prevented the possibility of accumulating a reserve. For a time the Interstate Commerce Commission upheld the refusal of the railroads.

When this phase of order No. 9 was presented to the commission by George F. Oxley and others, it gave an interpretation to the Public Utilities Commission of Maine modifying the order. The substance of the modification is that there is nothing to prevent public utilities from securing coal for storage purposes. Service order No. 9 entitles public utilities to preference in car supply as long as coal secured is used for current needs and not for storage, and such coal

as may be accumulated by public utilities under the regular car supply should not be used as an argument by the railways for reducing the number of cars that the public utilities may be able to secure otherwise for current needs under order No. 9.

The effect of the ruling is to make the accumulation of surplus coal possible if a utility has an opportunity to do so. Coal received in cars allotted under service order No. 9 must be burned as it is received. But coal purchased in the open market or supplied in the usual manner by mines on contract may be stored to create a reserve.

HOLD UP CONSTRUCTION OF PROPOSED ONTARIO PLANT.

Owing to the high cost of labor and material the Hydro-Electric Power Commission of Ontario has decided to indefinitely postpone the construction of the proposed auxiliary steam plant in the Niagara Falls district. The final bids submitted indicated that instead of a total cost of about $4,000,000 for the initial 50,000 hp. unit the work would cost over $5,500,000, and in addition the earliest delivery which could be guaranteed would not permit the plant being in operation prior to December of next year. It was estimated that the high cost of installation and operation and the price of coal would mean an additional cost of $10 per horsepower for power in the Niagara district.

DISTRIBUTION AND COST OF NATIONAL ELECTRICAL CODE.

Franklin H. Wentworth, secretary of the National Fire Protection Association, 87 Milk street, Boston, Mass., advises that the cost of reprinting the National Electrical Code has advanced from $4200 in 1918 to $9000 in 1920 for the same number of copies, and the booklet this year will cost 6 cents per copy. In past years the code has been freely distributed by the National Board of Fire Underwriters and no special steps were taken to avoid waste. This year the cost being so great, the executive committee has endorsed a resolution that the new edition be sold in quantities at 5 cents a copy. Requests made now will be filled as soon as the booklets are received by the executive office.

FACTORY WORKERS FOR FIRST TIME RECEIVE VACATIONS.

Hawthorne Works of Western Electric Co. Adopts New System to Give Substantial Expression of Appreciation for Faithful Service.

Four thousand shop employes of the Western Electric Co. will receive a vacation with pay this summer for the first time in the history of the company. The board of directors has promulgated an order extending the vacation privilege to every department. Previously factory workers did not receive the same benefits as the members of the sales, clerical, technical and executive branches and any time off during the summer months was taken at their own expense.

When the new system was announced at the Hawthorne Works near Chicago, J. W. Bancker, assistant general superintendent of the plant, said: "This is believed to be one of the first instances in the history of the Chicago industry where annual vacations with full pay have been extended to factory employes of all classes."

The innovation was decided upon to afford some substantial expression of appreciation for faithful service. Length of service is the basis of eligibility. Employes who have been with the Western Electric ten years are allowed two weeks with pay, while those who have been in its employ five years and less, receive one week. Where it is possible the preferences of the personnel for any certain period of absence will be granted. It is expected that the new scheme will mean an annual cost of several hundred thousand dollars which will be included in the big budget which has been set aside to promote the present spirit of good feeling between the company and its workers.

COMING CONVENTIONS.

Nebraska Section of the National Electric Light Association. Annual convention, Omaha, Neb., Sept. 8-9. Secretary, B. H. Conlee, Nebraska Gas & Electric Co., Beatrice, Neb.

Pennsylvania Electric Association. Annual convention, Bedford Springs, Pa., Sept. 8-11. Secretary, H. M. Stine, 211 Locust street, Harrisburg, Pa.

Northwestern Geographic Division of the National Electric Light Association. Annual convention, Spokane, Wash., Sept. 8-11. Secretary, L. A. Lewis, Washington Water Power Co., Spokane, Wash.

Rocky Mountain Section of the National Electric Light Association and Colorado Electric Light, Power & Railway Association. Joint meeting, Glenwood Springs, Colo., Sept. 13-15. Headquarters, Colorado Hotel.

Association of Edison Illuminating Companies. Annual convention Eastern Point, New London, Conn., Sept. 13-16. Headquarters, Griswold Hotel. Secretary, Preston S. Millar, 80th street and East End avenue, New York City.

New England Section of the National Electric Light Association. Annual convention, Kineo, Me., Sept. 13-16. Secretary, O. M. Bursiel, 149 Tremont street, Boston, Mass.

Indiana Electric Light Association. Annual convention, French Lick, Ind., Sept. 15-17. Secretary, Thomas Donahue, Lafayette, Ind.

Association of Iron and Steel Electrical Engineers. Annual convention, New York City, Sept. 20-24. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

Illuminating Engineering Society. Annual convention, Cleveland, Oct. 4-7. General Secretary, Clarence L. Law, 29 West 39th street, New York City.

National Association of Electrical Contractors and Dealers. Annual convention, Baltimore, Md., Oct. 4-9. Headquarters, Southern Hotel. Secretary, W. H. Morton, 110 West 40th street, New York City.

Electric Furnace Association. Meeting at Ohio State University, Columbus, O., Oct. 6. Secretary, C. G. Schluederberg, Box 911, Pittsburgh, Pa.

Empire State Gas & Electric Association. Annual convention, Utica, N. Y., Oct. 7-8. Headquarters, Hotel Utica. Secretary, Charles H. B. Chapin, 29 West 39th street, New York City.

National Association of Electrical Inspectors. Annual meeting, Philadelphia, Oct. 12-13. Secretary, W. L. Smith, Concord, Mass.

International Association of Municipal Electricians. Annual convention, New Orleans, La., Oct. 19-22. Secretary, Clarence R. George, Houston, Tex.

Electric Power Club. Fall meeting, Hot Springs, Va., Nov. 15-18. Headquarters, Homestead Hotel. Secretary, C. H. Roth, Adams and Loomis streets, Chicago.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

SUPPLY OF ELECTRICAL ENERGY TO LARGE CUSTOMERS.

High-Tension Service Now Supplied in Many Cases —Layout of Typical Substation—Relations Between Customers and Utility.

By R. H. Tillman.

Consolidated Gas, Electric Light and Power Co. of Baltimore.

Twelve years ago there were few public utility companies supplying energy in large blocks to power users. Particularly was this true in connection with industrial power users. The connection of a 100-hp. load to the lines 12 years ago was quite an event, and required several conferences of various heads of departments with the utility management to fully consider the dire consequences that might befall the somewhat uncertain generating and distributing systems. Again, it was felt that it would be no less than a crime to have high-tension service where the various customers would have access to the control equipment, and that the customer should not use within his premises a voltage higher than 220. And it is found even at this date that this false impression is so imbued in the minds of many manufacturers that it is impossible to convince them to use a higher voltage.

Therefore, it has been a matter of education not only with manufacturers but with central-station companies that has made it possible for the wonderful expansion of the wholesale use of electrical energy by large customers.

This can well be illustrated by one of the large eastern public utility companies where a high-tension or wholesale customer is one whose maximum hours demand is above 200 kw., provided the customer desires to purchase his own equipment for the transformation of high-tension energy. This particular central-station company less than nine years ago had no customers on its lines using high-tension power. Today it has 43 customers with 60 substations, with a connected load of 185,000 hp. The actual energy sold through these 60 substations approximates 300,000,000 kw-hrs. per year, and in 1919 over 70% of the total power supply of the company was consumed by customers with high-tension service. This growth from zero to 70% in less than nine years indicates clearly the ever-increasing importance of large customers to public utility companies, as well as the wonderful opportunity that public utilities have in assisting industrial development in their respective communities.

However, along with this remarkable increase of central-station industrial power business goes the responsibility of the company in determining the best method of rendering the most satisfactory service to each of its large customers. The

Fig. 1—Method of Utilizing Substation Walls as Supports for Wiring and Equipment.

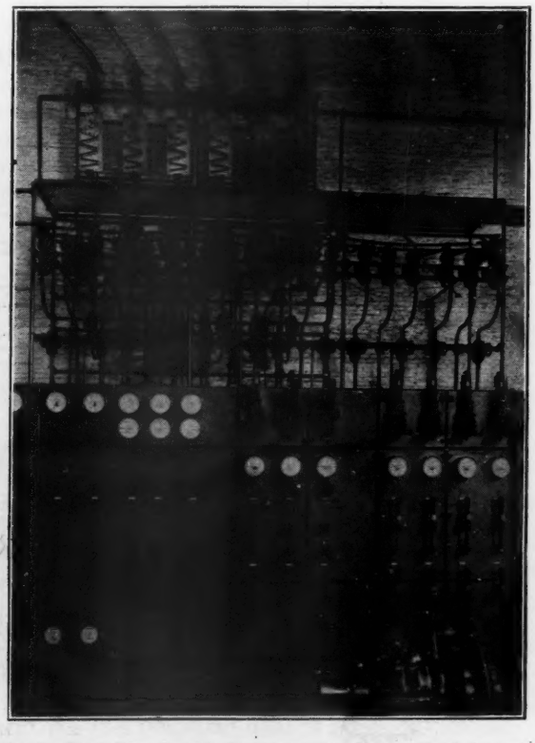


Fig. 2—Pipe Framework Supports Are Not as Satisfactory as Those Shown in Fig. 1.

responsibility from a physical standpoint can be definitely outlined, but it is evident to all progressive central-station companies that there is a moral obligation that goes further and does not end until the good-will of each and every customer is obtained. It is possible for the public utility to supply better service at lower rates than an industrial customer can obtain from any other source. It is with this thought in mind that the management of the public utility obtains the best talent and advice and advises its customers that good talent and engineering advice is at their disposal at all times.

High-Tension Service Economical for Customer and Utility.

The greatest number of large public utility companies now sell power at wholesale high-tension rates. These rates are cheaper than the low-tension power rates, the percentage of difference depending on the customer's load-factor and method of operation. This lower rate for wholesale energy is warranted because of the saving in distribution losses and fixed charges. The customer owns the substation and substation equipment located on his premises; also when situated in the underground district the customer furnishes the necessary duct on his private property.

The company previously referred to furnishes all information necessary for the customer with reference to what is required for the customer to supply. The latter usually prefers this public utility company to handle the entire substation equipment, since it is the most important part of the power supply as far as the customer is concerned, and, therefore, he fully realizes that the public utility company will specify and install the best of apparatus with the best workmanship, since any interruption would mean a heavy loss to the operator as well as to the customer. Therefore, the large customer assumes, and it is a fact, that the primary object of the public utility in undertaking to do the substation work is to guarantee to both the utility and industry a reliable, economical and satisfactory substation. As the proper service depends on the arrangement and class of equipment in the substation, it is inter-

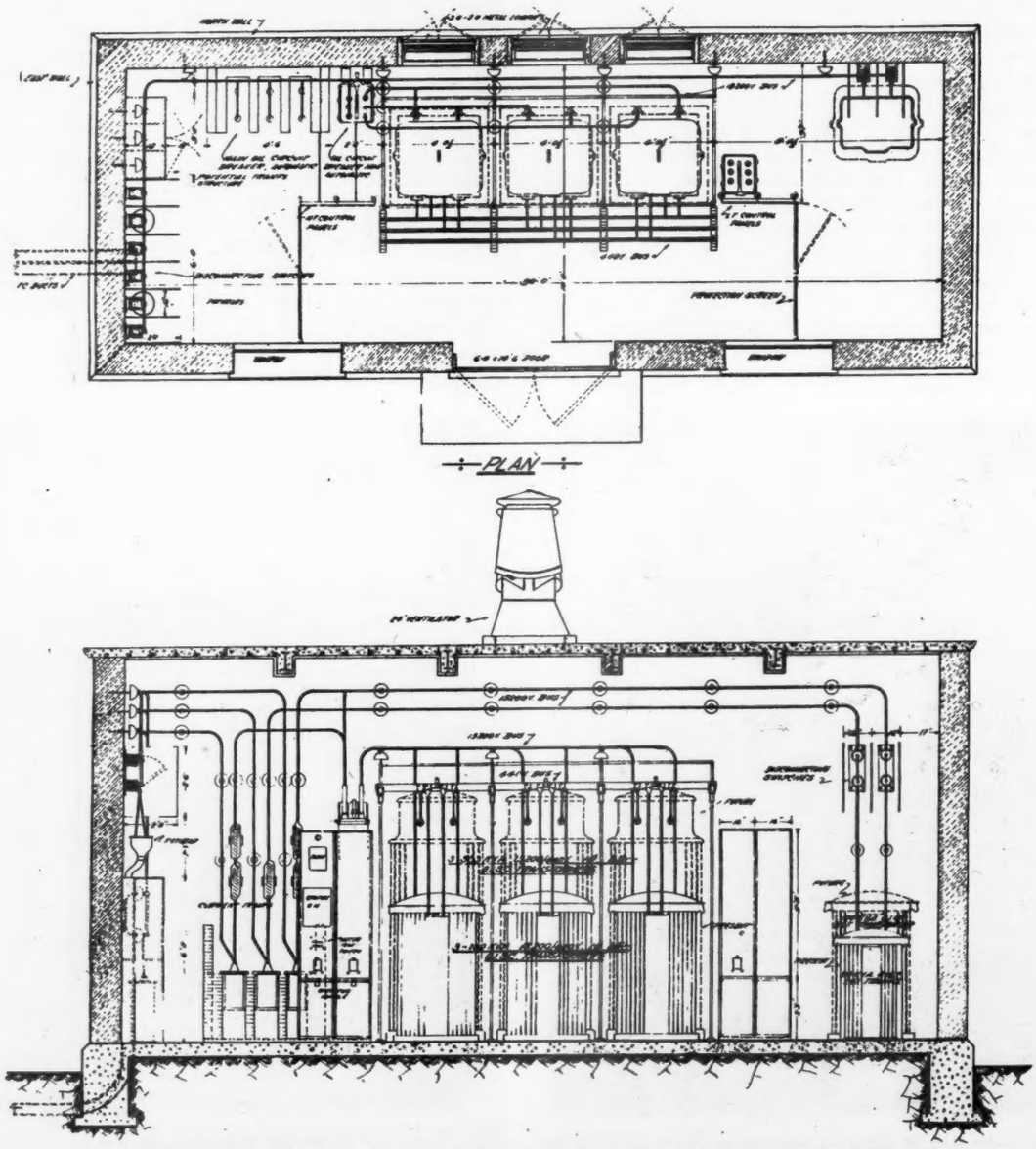


Fig. 3—Layout of Typical Substation for Serving Customers With High-Tension Power.

esting to note how this problem is handled by the public utility company mentioned.

Description of Typical Substation and Auxiliary Equipment.

Figs. 3 and 4 show the layout of a typical substation of approximately 250-kw. capacity, the location being within the city limits and in the underground district.

The general arrangement of any customer's substation should be made with the idea of safety and reliability first, and simplicity and appearance second. In this design of substation it has been found possible to maintain a high degree of simplicity without affecting safety, this simplicity resulting in economy rather than in additional expense. To utilize the substation walls as supports for wiring and miscellaneous equipment rather than provide separate pipe framework supports has been found to give greater advantage. It results in simple arrangement of conductors, disconnecting switches, current transformers, etc., and causes the actual wiring and arrangement to appear as a wiring diagram to the station operator. This simplicity is shown in Fig. 1 and is undoubtedly preferable to the arrangement as shown in the pipe framework support arrangement as shown in Fig. 2.

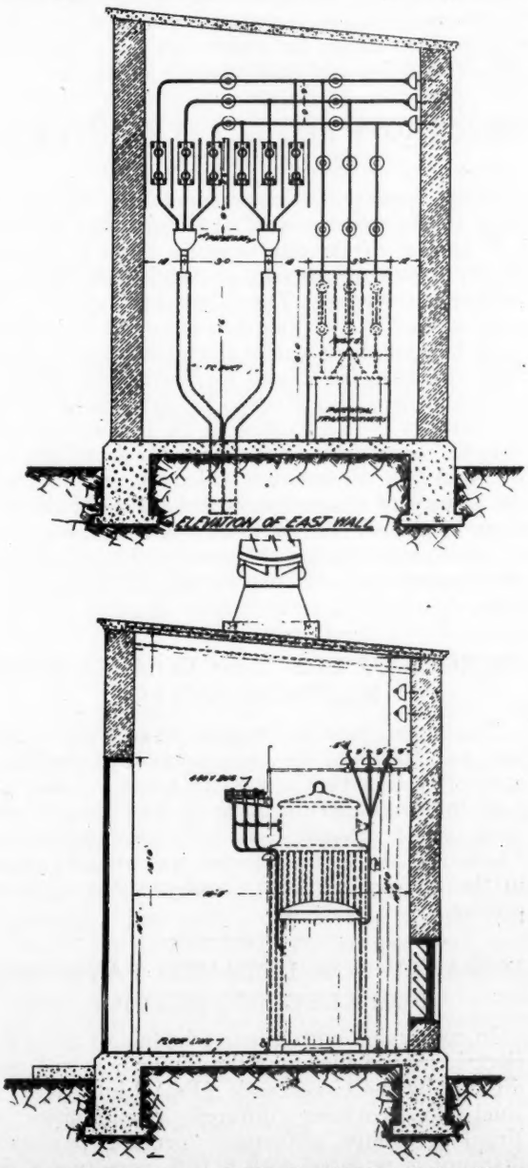


Fig.4—Side Elevations of High-Tension Substation Shown in Fig. 3.

It is important in the supply of electrical energy in large blocks to industries that proper feeders, lightning protectors, disconnecting switches, overload and no-load protection, power and lighting transformers and metering equipment be used. Industrial manufacturers and public utility companies should be most interested in the effectiveness of all equipment through which electrical energy is to be supplied to the manufacturing process. They are interested in seeing that all electrical energy is used to the best advantage for the production of the user's commodity, that the details of the user's operation, such as the kind of machinery, the arrangement of machines in reference to location of the product manufactured, the speed of each and every machine that would produce the best quality of output with the least labor, and that the proper size and type of equipment be selected throughout. From actual experience of the above-mentioned company, the arrangement of the high-tension equipment shown in Fig. 1 gives very good satisfaction, but at the same time the public utility company as well as the customer is always concerned with the size of equipment installed. If the equipment selected is too large, its first cost is high and the cost of operation greater; if it is too small the user can not get the required work out of his manufacturing machinery. Also, if the proper size of equipment is not selected, the service to the user will be impaired and both the utility company and the user may suffer.

Proper Relations Maintained Between Customer and Utility.

The relations that exist between the public utility and its customers depend both on the effect produced by the contact of its employes and its customers and the service supplied. It is recognized by the public utility companies that well-trained employes are necessary to handle the problems in connection with the supply of large blocks of power to its customers.

The policy of the above-mentioned company is to have technically trained representatives in its new-business department to deal with large industries. These representatives are required to familiarize themselves with the present customers or prospective customers' business in order that they may be competent to consult with and advise on all matters not only pertaining to high-tension supply of service but also to all power applications. This relation between a large power user and public utility representative does not end when the contract is consummated, or when equipment is completely installed and service cut in, but each individual utility representative encourages his customer to refer to him concerning all matters between their respective companies during the life of the contract. The company's designing engineering department as well as all other departments co-operate with the representative, but do not deal directly with the power user. In this way one man is made responsible for the relation with the customer, and because of this the customer feels that the company is

taking a personal and special interest in all his problems and is familiar with his conditions.

This method of personal contact with the customer of the public utility is maintained further by the company's system of meter reading. It is the practice to have the customer's operator, after first being instructed how to read the meters, mail to the new-business department of the company daily the index of the integrating watthour meters and also the graphic meter charts on forms furnished by the company. This enables the public utility to keep closely in touch with the customer's operating conditions and furnish the company with accurate information for proper billing, as well as giving the power user a daily record of what is transpiring in his plant.

FACTORS AFFECTING THE UTILITY FINANCIAL SITUATION.

Francis H. Sisson Discusses Present Condition of Public Utilities and Need for Higher Returns for Service Rendered.

In an address on "Factors Affecting Our Financial Situation," delivered before the National Boot and Shoe Manufacturers' Association, Francis H. Sisson, vice-president of the Guaranty Trust Co., New York, said:

"A menacing factor in the present situation is the condition in which we find our utilities, which have literally been ground between the millstones. They have had to contend with wages and prices of materials increasing by leaps and bounds on the one hand, and on the other with a more or less stationary return for services rendered.

"The street railway that carried the men who labored in the factories, and the power company that furnished the power to keep many of the factories running, were left to get along as best they could on the steadily shrinking margin between operating costs mounting higher and higher under the control of world conditions, and income mounting very slowly, if at all, under the control of numerous public officials.

"Regulating bodies have been reluctant to grant increases in rates in any degree commensurate with the increase in prices and wages, and in many cases no increases in rates whatsoever have been permitted. Not only have regulating bodies stood in the way of an adequate return, but in numerous instances franchise restrictions on rates have had to be contended with. In too many cases public officials, supported by an uninformed and frequently by a perhaps purposely inflamed public opinion, have refused to consider the need for revision of franchise restrictions. They seem to ignore the fact that these maximum rates were written into the franchises in periods when conditions were vastly different and the conditions of today could not be foreseen. When a price upheaval, such as that occasioned by the war, occurs, and reduces by 50% the purchasing power of money, there should be, in all justice, such a revision in franchise restrictions as would enable the utilities to cope with the new conditions. Instead of taking a broad-minded position, many municipal authorities, in the words of Edison, 'choose to take their pound of flesh,' forgetting what the future penalties of their action may be in the way of decreased service, widespread loss to investors, and greatly damaged credit for both utilities and municipalities."

The Supreme Court of Illinois has held that the commission has the right to change franchise restrictions, as suggested by Mr. Sisson, and this power of commissions has been upheld by the Supreme Court of the United States.

OKLAHOMA GAS & ELECTRIC CO.'S CONCEPTION OF "SERVICE."

The following is quoted from a recent advertisement of the Oklahoma Gas & Electric Co., Oklahoma City, Okla.:

"Public service, conscientiously rendered, knows no 'day's' work. Its customers are found in every walk of life. The need for its services is universal. Its responsibility extends from sun to sun and those who would assume its obligations must do so with no thought of personal privilege. Whether the hour is high noon or deep midnight, they must be public servants, ready and anxious to give to customers—not merely those things for which they pay—but individual attention and more than is demanded."

KERCKHOFF PROJECT IS STARTED IN CALIFORNIA.

With appropriate ceremonies and before a large throng of interested spectators, the Kerckhoff project of the San Joaquin Light & Power Corp., Fresno, Cal., was placed in operation at Auberry last week. The 14,200-kv-a. generators were started by two switches mounted on a platform located about a mile from the power house, the switches being closed by William K. Kerckhoff, president of the corporation, assisted by R. C. Starr, Jr. The starting of the generators was preceded by a short program of speaking, during which A. G. Wishon, general manager, outlined the history of the company and spoke of the efforts to finance the necessary development. R. C. Starr, construction engineer, and A. C. Balch, vice-president of the corporation, also made brief talks.

MERGER OF ELECTRIC COMPANIES IN MASSACHUSETTS.

The Massachusetts Department of Public Utilities has approved the consolidation of the Buzzards Bay Electric Co. and the Cape & Vineyard Lighting Co. under the name of the Cape & Vineyard Gas & Electric Co., with headquarters at Falmouth, Mass. The merger was brought about in the interests of better and more economical service.

PENALTY FOR DELAYED PAYMENTS FOR ELECTRIC SERVICE.

In connection with a new schedule of rates for electric service, filed with the Public Service Commission by the Greencastle (Pa.) Light, Heat & Fuel Co., covering different communities in Franklin county, a former "prompt payment" discount is replaced with a 10% penalty for delayed payments.

OPERATING PRACTICE

Methods and Problems Embracing Operation and Installation of Power-Plant Equipment and the Distribution of Electrical Energy

DUQUESNE LIGHT CO. BUYS ANOTHER 60,000-KW. UNIT.

So great has been the demand for electrical energy by various industries within reach of its lines that the Duquesne Light Co., Pittsburgh, has arranged for the doubling of the proposed initial installation of 60,000 kw. at its new Colfax power plant. The second 60,000-kw. turbine-generator with 100,000 sq. ft. of surface condensers divided in four shells, which has just been ordered from the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., will be a duplicate of the first machine. It will be designed to operate at maximum efficiency when subjected to a load of 50,000 kw., and to take care of a maximum load of 70,000 kw. for short periods.

Steam will be supplied to the turbine at a pressure of 275 lbs. per sq. in. and at a superheat of 175 deg. F. The condensers will maintain a vacuum of 29 in.

In addition to the equipment mentioned a 2000-kw. a-c. house turbine has been ordered to furnish energy for the plant auxiliaries.

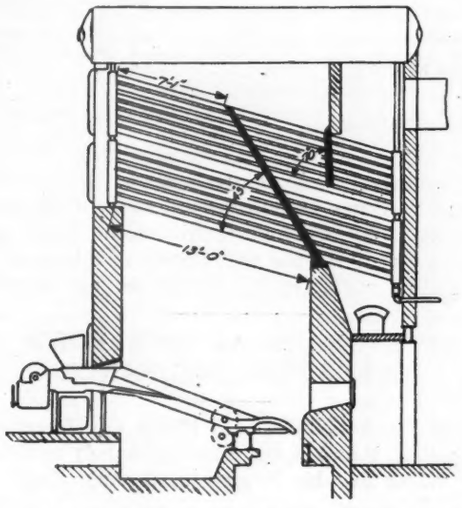
SPECIAL FEATURE OF BAFFLE WALL CONSTRUCTION.

Large Front Pass Gives Radiant-Heat Characteristic and Small Rear Pass Gives Waste-Heat Characteristic to Boilers.

Baffle-wall construction is apparently attracting the attention of combustion engineers and baffles are being designed and successfully constructed which would have been thought revolutionary a few years ago. One field just entered upon is the application of the high-velocity theory, recently developed in connection with waste-heat boilers, to radiant-heat boilers. According to this theory, gases of low heating value must be speeded up so that a large volume shall be brought in contact with each unit of heating surface in a given time. By building the front baffle with a long slope, making the front pass as large as possible, and the rear passes narrower than usual, the front end of the boiler is run as a radiant-heat and the rear as a waste-heat boiler.

The gases move slowly through the voluminous first pass with ample time to transfer their heat to the heating surfaces, the pass being proportioned to the cooling and shrinkage in gas volume. The baffle wall closes in so as to compel the gases to fill the entire space and reach the surface near the front of the top header. On making the turn at the top of the front pass and passing through the superheater the speed is increased, and the narrowing space increases the density of the gas and accelerates its movement so that the rear tubes are flooded with a denser gas moving at a high velocity, and the heat transfer is a maximum.

The apparent restriction at the bottom of the



Turner Baffle Wall Construction of Unique Design.

rear baffle is only apparent as the gases on making the turn have the advantage of parallel flow along the tubes instead of only the cross flow between tubes, and the space between decks is also utilized to provide additional area.

MOTOR MORE ECONOMICAL FOR PUMP THAN GASOLINE ENGINE.

After Five Years of Operation a Motor-Driven Pump in Windsor, Conn., Shows Considerable Saving in Operating Cost.

A motor-driven pump, installed in the pumping station at Windsor, Conn., has proven to be satisfactory and superior in every way to the engine-driven equipment formerly used, according to an article appearing in *Public Works*. The electric pumping equipment, which was installed in 1915, consists of a 10-in. by 12-in. Smith-Vaile triplex double-acting pump, having a capacity of about 1050 g.p.m., and is operated by a 100-hp. Westinghouse slip-ring motor. Power is furnished by the Hartford (Conn.) Electric Light Co. at 4800 volts and is reduced to 220 volts at the station. The apparatus is controlled automatically by a Westinghouse a-c. magnet switch starter actuated by a pressure-gauge switch. This automatic starter provides for emergency operation, but under normal operating conditions an attendant is present to care for oiling, chlorine control, etc.

The total operating cost of the motor-driven unit during the last half of 1919 was $1265.53.

during which period 45,913,000 gals. of water was pumped against a total head of 273 ft. This cost figure includes wages, power, oil and repairs, but not interest or depreciation.

Prior to the installation of the motor-driven unit pumping service had been supplied by gasoline-engine-driven equipment, which equipment was modified and retained as emergency or reserve apparatus. Comparison of the unit costs of pumping with engine and motor-driven equipment is shown in the accompanying tabulation.

COMPARATIVE COSTS OF PUMPING WATER PER 1000 GALS AGAINST A 273 FT. HEAD.

	Gasoline Engine.	Electric Motor.
Attendant	$0.0081	$0.0081
Power	0.0250	0.0170
Oil and supplies	0.0005	0.0009
Repairs	0.0011	0.0016
Total	$0.0347	$0.0276

These figures show a decided advantage in favor of the electric equipment in spite of the fact that it was working at only about 20% of its rated capacity. Higher load-factor would have considerably reduced the unit power cost because of the sliding scale feature of the service contract.

COAL STORAGE AS ONE FORM OF OPERATING INSURANCE.

Central-Stations or Isolated Plants Can Counteract Weather, Railroad and Labor Troubles by Providing Suitable Reserve of Storage Coal.

By Guy S. Hamilton,
American Steam Conveyor Corp., Chicago.

It would take no small amount of computation to correctly figure the loss that was incurred by manufacturing interests because of the coal strike last winter. A few concerns by chance or foresight had on hand a sufficient quantity of coal to keep their machines turning, but a great majority of the power plants were forced to reduce or suspend operations. They had but a few days' supply on hand, and when that was exhausted their machines became idle.

Coal storage is plant insurance. "My experience last winter has proven to me the value of an adequate supply of coal," said one executive. "Ordinarily the only coal we have on hand is that in our power-house bunkers and in the railway cars on the siding. We received our coal on a regular schedule and saw little need for maintaining a store yard. However, we will never be caught again. Before winter arrives we will have installed equipment for handling and storing coal. Our engineers are investigating the subject now."

This executive is only one of a great number who have profited by experience. Interest displayed by prominent manufacturing concerns all over the country is evidence of a growing appreciation of coal storage. "Contract now for your year's supply of coal" is the advice of one authority on coal prices. "During the spring and summer months the price of coal is usually at its lowest ebb. It is good business to buy at low prices, as every sensible business man knows."

There are other factors that should be taken into consideration apart from the price standpoint. If a plant operates on a week-to-week basis and a strike occurs at the mines or among the railroad employes, coal must be secured from local sources at advanced prices or the plant will be shut down. An unusual shortage of cars or severe weather are other important factors that may cripple the power plant that does not maintain a coal reserve.

Based on the law of averages, it is a good business proposition to buy coal for storage in the spring and early summer. The right method of coal handling is a matter of considerable importance. There are a number of types of machinery on the market, each serving its particular purpose and field. Provision should be made in every case for the handling of coal from railway cars not only to the storage pile, but also from the pile or car to the coal bunkers in the plant.

An installation that meets these requirements consists of an overhead carrier system with a bucket and trolley on a monorail track. As coal cars are delivered to the plant they are moved into place over a shallow track hopper, the bottom of which is inclined at an angle of 45 deg. to the horizontal. Coal is dumped into the hopper and slides toward the lower end, where a gate is located. A bucket-loading pit is situated just beyond the gate, deep enough and so located that the bucket can be placed directly in front of and beneath the gate. In placing the bucket in position small wheels on its side engage on tracks at each side of the loading pit, and as the bucket is lowered away the track guides the bucket into place. The movement of the bucket and trolley is controlled by a hoist generally located at the bucket loading pit. The hoist operator performs the operations of loading, hoisting, conveying, emptying and returning the bucket from his station. Coal can be handled at an average speed of 30 tons an hour, five or six cars daily, one man performing all operations.

Carriers of this type can be adapted to meet the condition of practically any plant. Their cost is not great, and, once installed, they soon pay for themselves in economy and convenience. The present conditions are such that no plant can afford to take chances. Gambling on an abundance of coal and steady delivery is gambling with the odds against the man who neglects storage. Coal storage is insurance, and insurance of the soundest kind. The wise power-plant owner is not taking unnecessary chances. He is storing coal at convenient times and preparing against any future trouble.

IMPROVED METHOD OF MEASURING HYSTERESIS VALUES.

After reviewing former attempts to measure hysteresis values with apparatus of a modified isthmus type, and discussing possible causes for errors in observation, an improved method for measuring hysteresis values by means of this apparatus is described in Scientific Paper No. 383, entitled "Measurement of Hysteresis Values from High Magnetizing Forces," recently issued by the Bureau of Standards, Washington, D. C. The results agree favorably, within the experimental error, with those obtained on standard types of apparatus. Observations, carried as high as $H = 2500$ gausses, are shown graphically.

NEW APPLIANCES

Newly Developed and Improved Electrical and Mechanical Apparatus, Appliances, and Devices Now Being Placed on the Market

A High-Temperature Refractory Cement.

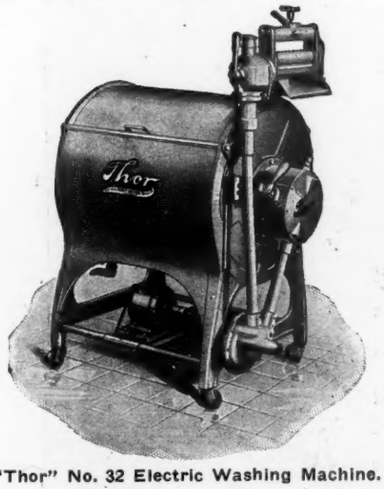
A refractory cement known as "Vulcan Paste" is being marketed by the Pyrolectric Instrument Co., Trenton, N. J. This material is used in high temperature work to close cracks, cement together refractory pieces, cover furnace windings, etc. Used as a paint on quartz or glazed porcelain ware, it gives protection to the surface when this comes in contact with molten metals.

Vulcan paste is unaffected by temperatures under 2000 deg. C., according to the statement of the manufacturer. It has little or no corrosive action on metals. It will harden at room temperatures, but only becomes very hard after being submitted to a high temperature.

Another Model of "Thor" Electric Washing Machine.

"Thor" No. 32 electric washing machine is the latest achievement of the Hurley Machine Co., Chicago, and represents the results of 14 years of experience and uninterrupted progress in manufacture by this company.

The body of the "Thor" No. 32 is constructed entirely of steel. All corners and edges are rounded and heavily reinforced. The interior is of either heavily galvanized steel or copper. The curved top is arranged so that it can



"Thor" No. 32 Electric Washing Machine.

either be thrown back or removed if desired. It is equipped with the "Thor" all-metal, five-position swinging wringer. The frame of the wringer is built entirely of metal and is connected to the washer in such a way that it cannot sag or weaken the body, according to the manufacturer.

All wringer gears are disengaged with the swinging of the wringer, one handle regulating both the swinging and operating mechanism. Pressure of the rolls is controlled by a single tension screw, while an instantaneous trigger release insures safety in operation. The machine has a capacity equivalent to ten sheets, permitting its use in small hotels, hospitals, institutions, colleges, etc., as well as in private homes.

This latest model of the "Thor" is of the revolving, reversing-cylinder type, and is operated by inclosed gears and shafts. The cylinder is of either metal or wood and can be easily removed. The wood cylinder is said to present the advantage of ease in cleaning without removal.

Electric Dry-Type Glue Pot in Two-Quart Size.

An electrically heated dry-type glue pot in a two-quart size has been added to the merchandising line now marketed by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. The pot consists of a glue vessel of copper contained in a steel case, all solidly constructed. The glue receptacle, which

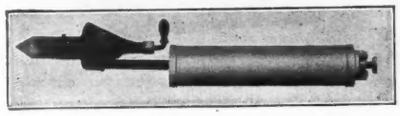
Two-Quart Electric Dry-Type Glue Pot.

may be easily removed for cleaning, fits snugly into the case making a perfect thermal contact with the heating element.

In this type of glue pot the water bath is eliminated, thus obviating the danger of evaporation of the water and the possible burning of the glue and burning out of the heater. Current can be applied continuously in this type of pot without danger of overheating the glue or burning out the heater. Another point of efficiency lies in the direct application of the necessary heat to the glue, none being wasted for heating a water bath. Much time is also saved because the glue is heated directly and held at the proper temperature.

Soldering Iron and Blow Torch for Electricians.

The "Everhot" soldering iron and blow torch combined, is a departure from the usual construction of such tools. It is a compact, light and handy tool for electrical shop or exterior work, and is being placed on the market by Belfrey & Craighead, Tribune building, Chicago. The cylindrical handle contains the reservoir for the gasoline and the pump for compressing the air. The burner is so constructed that the gas is pre-heated before it enters the chamber back of the needle valve, thus insuring perfect combustion and regulation under any condition. A feature of the tool is the two-piece needle valve, which is provided with a shoulder for seating so that the needle point cannot be forced through the valve



"Everhot" Combined Soldering Iron and Blow Torch.

opening. A heavy soldering tip is provided for heavy work, but for use in electrical work a small tip is provided. The tip is easily removed when it is desired to convert the tool into a blow torch. The total weight of the tool is 2 lbs., and the total length is 16.5 ins. It may be easily suspended from the linemen's belt, and takes but little room in the tool kit. It may be operated four hours on a half pint of gasoline.

Elevator Controllers of Simple and Rugged Design.

The entire line of d-c. and a-c. elevator controllers manufactured by the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has been replaced by a new line of controllers of fewer types and simpler construction for intermittent elevator service. Although the new controllers retain the general design of the previous ones, they have in addition the following main features: Standardized carbon-to-copper power contacts which are non-freezing and quiet in operation, and time-limit acceleration by a simple dashpot relay which is accurate in operation and provides smooth acceleration regardless of load conditions.

With d-c. equipments, acceleration is effected by cutting resistance out of the armature circuit. The time interval allowed the motor to come up to speed is determined by the setting of a dashpot relay, which is externally adjustable for time values, and when once set will always cut the resistance out of circuit in the same length of time. The relay consists of a magnetic solenoid which actuates a plunger moving in an oil dashpot, and is plainly shown in Fig. 1, which is a view of a small controller for use with slow-speed elevators. As the plunger moves upward, upon closing the pilot circuit, it rotates a rocker arm carrying a series of fingers, which cut out the resistance step by step in the controller shown in Fig 1, or, in the controller in Fig. 3, causes the accelerating magnet switches to close one by one.

The resistor which was automatically inserted in the solenoid circuit in the former controllers has been omitted, as the coil is of sufficient size to prevent overheating on intermittent duty.

The dashpot is totally inclosed, preventing oil leakage or splashing, and has

an exterior adjusting screw for time regulation.

A special dashpot oil is provided, with a viscosity which varies only slightly over wide ranges in temperature. A test conducted with this relay from 30

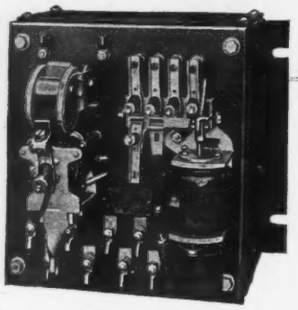


Fig. 1.—D-C. Elevator Controller with Time-Limit Acceleration for Slow-Speed Elevators.

to 90 deg. F., without changing the dashpot adjustment, showed hardly a noticeable variation in time.

The elevator controller shown in Fig. 1 consists of a main-line contactor and timing relay, mounted on a slate panel carried on a wall-type frame controlled by the reversing switch, Fig. 2, which is operated from the cage by wheel, lever or rope. The magnetic main contactor on the control panel has carbon-to-copper contacts and a strong magnetic blowout. It makes and breaks the main-line circuit, thus relieving the reversing switch of that duty. The series field of the motor is cut out in one step after starting, and the design is such that the motor can be reversed only when all the starting resistor is in circuit.

The reversing switch has the fingers inverted with reference to the former design. This makes the terminals readily accessible when the cover of the switch is removed, and the copper dust from the contacts falls to the bottom of the switch without danger of causing a short-circuit between poles.

A similar type of controller designed for heavier duty has magnetic accelerating switches in the motor circuit, and the dashpot mechanism is used as a pilot relay.

The d-c. full-magnetic controllers for operation by car switch or push buttons are of the same general design as those previously described, but have magnetic reversing switches on the control panel, and are built for one or two-speed service. Five and six steps of acceleration are provided on the single-speed, and eight steps on the two-speed controller. A two-speed controller is shown in Fig. 3. The limiting speed for single-speed equipments is 200 ft. per min. with elevators and 300 ft. per min. with dumb waiters. Two-speed equipments may be supplied up to 400 ft. per min.

Dynamic braking and overload protection are furnished as standard equipment on all two-speed equipments, and single-speed equipments rated over 25 hp., but are furnished on other controllers when desired.

For high-torque, polyphase, squirrel-cage motors, the control equipment consists of a double-pole main-line contactor, with reversing switch shown in Fig. 2, or a panel carrying double-pole reversing contactors and a double-pole main-line contactor. The former is operated from the elevator cage by wheel, lever or rope, and the latter by car switch or push buttons. The push-button equipment and controller may also be used with dumb waiters.

The equipments for slip-ring induction motors may be operated from the cage by wheel, lever or rope, or by car switch or push buttons. The former controller has three double-pole main-line contactors, one acting as a primary switch, and the other two as accelerating switches, controlled by a timing relay, which consists of a solenoid and plunger controlled by a gravity air dashpot. The reversing switch shown in Fig. 2 is part of this equipment.

The controller for car-switch or push-button operation consists of a double-

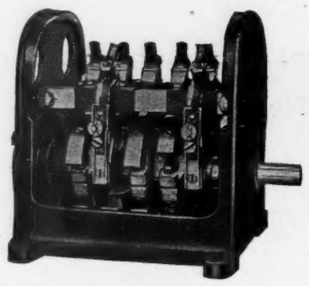


Fig. 2.—Reversing Switch with Cover Removed, Showing Construction and Arrangement of Segments and Fingers.

pole primary contactor, two double-pole reversing contactors, and three and four double-pole accelerating contactors, controlled by a timing relay. This controller may be used with elevators having any number of landings.

Both a-c. and d-c. equipments are arranged so they may be used with electric brakes. Standardized carbon-to-copper contacts are employed on all controllers, and these contacts are interchangeable on a-c. or d-c. equipments of like capacity. Only two sets of power contacts, nominally rated at 100 and 200-ampere capacity, are used. Fig. 4 shows a special 25-hp., 440-volt automatic controller having contacts of 400-ampere capacity.

When so ordered, these equipments are supplied with overload relays, non-interference relays, limit switches, and other protective devices.

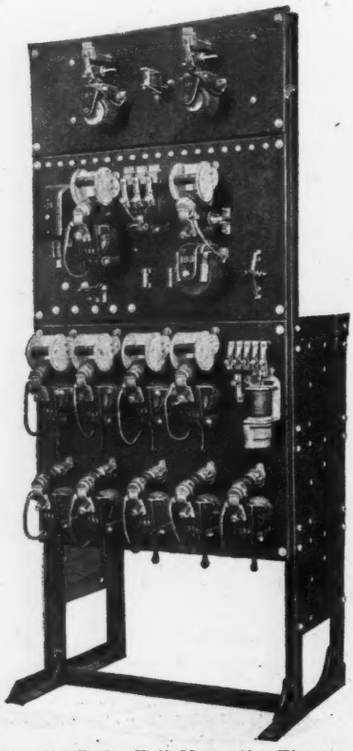


Fig. 3.—D-C. Full-Magnetic Elevator Controller with Dynamic Brake.

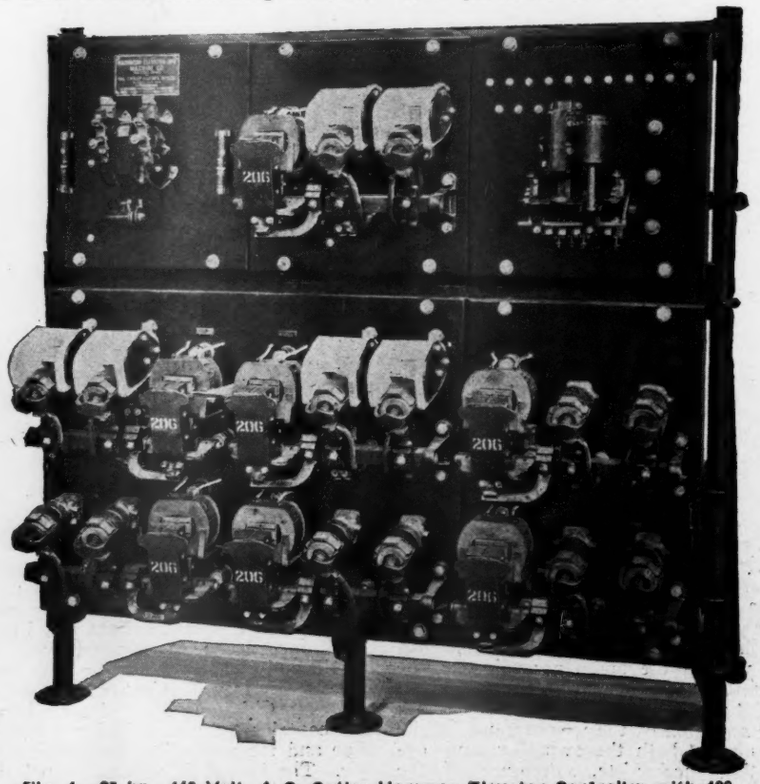


Fig. 4.—25-hp., 440-Volt, A-C. Cutler-Hammer Elevator Controller with 400-Ampere Switches.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Western Electric Co. has awarded contract to James Shedden & Co. for a four-story warehouse, 195 by 160 ft., to be built in connection with its large plant at Hawthorne, Ill. The building is estimated to cost $750,000 and construction has already begun.

Amber Electrical Supply Co., 553 West Madison street, Chicago, has had plans prepared for construction of a building on the southeast corner of Desplaines and Adams street at a cost of $250,000. The building will be seven stories high, with basement, and will occupy a space 68 by 75 ft.

Cutler-Hammer Manufacturing Co., Milwaukee, has issued a newsy broadside in three colors showing maps with election data of the 1916 presidential election, the object being to make it possible for the electrical dealer to attract attention to his window. In the upper lefthand corner of the broadside is a view of a C-H 70-50 switch on a toaster cord with the heading, "Selected by the Women on the Platform of 'Convenience.'"

General Electric Co. employes have an organization known as the Quarter Century Club which held its annual outing at Ballston Lake, N. Y., on Saturday last. The club has over 1600 members who have been with the company 25 years or more. They are recruited from plants in Schenectady, N. Y.; Erie, Pa.; Pittsfield and Lynn, Mass.; Fort Wayne, Ind.; Harrison and Bloomfield, N. J.; New York City, and district offices throughout the United States. The oldest man in years is 77 and the youngest 39. G. E. Emmons, vice-president, was presented with a gold replica of the club badge in recognition of his completion of 25 years as manager of the Schenectady works.

Electric Auto-Lite Corp., Toledo, O., held a sales convention of representatives of the Willys-Light Division of the company recently to organize for the fall selling campaign to market the quantity production of Willys-Light plants which is now being turned out. During the convention delegates were taken through the Toledo plants and the Knight motor plant at Elyria. The gathering was attended by more than 100 people, representing 67 distributing organizations throughout the country.

Westinghouse Electric & Manufacturing Co. will inaugurate work at once on the erection of a one-story foundry, 120 by 200 ft., at its Essington works, Philadelphia, to cost about $100,000.

United States Light & Heat Corp., Niagara Falls, N. Y., manufacturer of storage batteries, electric lighting and heating equipment, has recently experienced some changes in its personnel, John N. Willys and associates of Toledo, O., having acquired a large interest in the corporation. Mr. Willys has been elected chairman of the board of directors; E. H. Gold, vice-chairman of the board, and J. Allen Smith, president. The same interests have arranged to take over the Churchill street plant of the Curtiss Aeroplane & Motor Co., Buffalo, N. Y., to be used for the manufacture of motors for the Willys-Overland and Willys-Knight automobiles.

Mono Corporation of America has removed its main office from Buffalo, N. Y., to 25 West Broadway, New York City, where its line of automatic continuously recording gas-analyzing instruments for CO_2, CO, O_2, SO_2, H_2, N_2, CH_4, etc., will be displayed. F. D. Harger, vice-president and general manager, assisted by D. W. Reid and other chemical engineers and combustion experts, offer consulting service in matters relating to the automatic continuous recording of gas analysis in the scientific control of combustion and chemical processes. The following information in reference to the Mono system is given in connection with the above announcement: The characteristic of the Mono system lies in the commercially new feature (at least in America) of getting a continuous record of combustible gases (CO—CH_4) as well as CO_2 leaving a furnace with other products of combustion, where CO_2 has heretofore been the only one recorded for the purpose of controlling boiler and other furnaces. Many systems involving tables and curves have been developed whereby it was thought to make possible the attainment of maximum efficiency in combustion on the basis of a CO_2 record only. However, the particular percentage of CO_2 which indicates the maximum efficiency of a furnace varies not only with different furnaces and fuels but varies continuously in the same furnace with such factors as load, quality of fuel, thickness and uniformity of the fire bed, distribution of the air supply, draft, formation of clinkers, soot, etc. The presence of CO is an indication of incomplete combustion due to insufficient or improper distribution of air supply. A low percentage of CO_2 is an indication of excess or improper distribution of air supply. While the percentage of CO_2 rises with a reduction of air supply within certain limits it is evident that the critical point of economical combustion is reached at that point beyond which CO—CH_4 begins to appear in rapidly increasing volumes or in other words, the point beyond which incomplete combustion sets in with a decrease in air supply. Only by simultaneously and continuously recording not only CO_2 but also CO—CH_4 can this critical point be known at all times. This is what the Mono apparatus accomplishes. Instruments are also made for automatically analyzing and continuously recording percentages of O_2, H_2, SO_2, N_2, etc. in gas mixtures.

Habirshaw Electric Cable Co., Yonkers, N. Y., has recently made delivery to the United States government of 100 miles of submarine cable for use in the Philippines. The cable is made in two continuous lengths of 50 miles each and weighs 425,000 lbs. It consists of a single stranded No. 12 A. W. G. conductor, tinned, 40% rubber insulation and protected with galvanized steel armor wire cushioned with a layer of asphalted jute between the rubber insulation and the armor, and provided with an outside covering of asphalted jute. The interesting features of this cable are the long lengths in which it was made and the great weights involved.

Uehling Instrument Co., 71 Broadway, New York City, has issued Bulletin No 111 describing style U Uehling CO_2 equipment. This is a new design built in single and multiple forms, the latter serving any number of steam boilers simultaneously, up to a total of six. The purpose of this equipment is to save fuel by burning it with the proper air supply, neglect of this factor costing power plant owners heavily. The company states that among the notable features of the new machine are speedy action resulting from a new form of aspirator, absence of chemical solutions, greater simplicity and the unique plan of providing an auxiliary boiler front CO_2 indicator which guides the fireman, while the CO_2 recorder installed in the chief engineer's or superintendent's office makes a continuous (not intermittent) record showing all changes in boiler adjustments that are conducive to either waste or economy.

Representatives of Electric Auto-Lite Corp. Who Attended Sales Conference at Toledo.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

O. L. LEFEVER has been appointed superintendent of the Northwestern Electric Co., Portland, Ore.

C. O. FOSS, St. John, N. B., Can., has been appointed a member of the Hydroelectric Commission of New Brunswick.

HOWARD R. WILLIAMS is now connected with the sales department of the Electric Alloy Steel Co., Youngstown, O. He was formerly with the Youngstown Sheet & Tube Co.

E. E. HEDLER has succeeded W. O. Conley as eastern representative of the Buckeye Electric Division, National Lamp Works of General Electric Co., Cleveland.

L. T. MERWIN has been promoted from the position of general superintendent to that of assistant general manager of the Northwestern Electric Co., Portland, Ore.

W. E. BLODGETT has been appointed comptroller of the Winnipeg (Man.) Electric Railway Co. He was formerly secretary-treasurer of the Utah Light & Traction Co. at Salt Lake City.

FRANK L. BUTLER, Winnipeg, Man., has been appointed manager of the Winnipeg Electric Railway Co. He has been general superintendent of the properties since May, 1918.

F. D. FAGAN has been appointed vice-president of the Edison Storage Battery Co., Orange, N. J. He was formerly Pacific Coast sales manager of the General Electric Co.

EUGENE E. SMITH, formerly with the Metropolitan Electric Manufacturing Co., Long Island City, N. Y., has been appointed sales manager of the Ajax Electric Co., Jersey City, N. J.

HARRY J. BELL, formerly supervisor of safety for the Northwestern region of the U. S. Railroad Administration, has been appointed secretary of the Chicago local of the National Safety Council and the Chicago Association of Commerce.

W. WOODWARD WILLIAMS, formerly vice-president and general manager of the Reading (Pa.) Iron Co., is now assistant to the president of the Pittsburgh Gage & Supply Co., Pittsburgh, Pa., manufacturer of the "Gain-a-day" electric washing machine, ironing machine and vacuum cleaner.

WILIAM GREGORY CHACE has been appointed president and manager of the Canadian Lock Joint Pipe Co., Toronto, Can. Since 1913 he has been chief engineer of the Great Winnipeg Water District. Mr. Chace is a graduate of the University of Toronto and in 1905 became electrical engineer for the Temiskaming & Northern Ontario Railway Commission and in 1906 hydraulic engineer for the Hydro-Electric Power Commission of Ontario. From 1907 until a short time ago he was a partner in the firm of Smith, Kerry & Chace, consulting engineers, Toronto, and its successor, Kerry & Chace, Ltd., and during such period he was engineer in charge of the city of Winnipeg power development, and assistant general manager of the Mount Hood Railway & Power Co., Portland, Ore. Mr. Chace is a member of the Engineering Institute of Canada, and a past chairman of the Winnipeg branch, member of the Institute of Electrical Engineers, and a fellow of the American Institute of Electrical Engineers.

CARL D. JACKSON, chairman of the Railroad Commission of Wisconsin, has accepted an invitation to address the convention of the Investment Bankers Association at Boston in October on public utility regulation and financing.

LEE H. NEWBERT, formerly manager of the commercial department of the Pacific Gas & Electric Co., San Francisco, has been appointed manager of the Alameda district of the company. Mr. Newbert is president of the Pacific Coast Section of the National Electric Light Association.

THOMAS M. WATKINS, Alexandria, Va., has resigned as distribution superintendent of the Alexandria County Lighting Co. to become superintendent of transmission line construction for the Kentucky & West Virginia Power Co. He has also disposed of his interest in the local electrical contracting company of Watkins & Washington, Inc.

WILLIAM H. STEVENS, president of the Agricultural Insurance Co., has been elected chairman of the executive committee of the National Board of Fire Underwriters. Since 1882 he has been connected with the insurance company, having been successively assistant secretary, secretary and president, being elected to the last named position in 1904.

W. D. CHALMERS has been made assistant treasurer of the Baton Rouge Electric Co., Baton Rouge, La., vice E. P. Williams, who resigned to become assistant comptroller of the Godchaus Sugars, Inc., of New Orleans. Mr. Chalmers has been with the Baton Rouge company for several years, coming from the Columbus Electric Co., Columbus, Ga. Both the Baton Rouge and Columbus companies are subsidiaries of Stone & Webster, Inc., of Boston.

DR. E. B. ROSA, of the Bureau of Standards, Washington, D. C., has prepared a monograph entitled "The Economic Importance of the Scientific Work of the Government," which gives some decidedly interesting statistics regarding the expenditures of the federal government for the fiscal year ending June 30, 1920. These figures show that 67.8% of government expenditures are for obligations arising from the recent and previous wars; 25% for current military needs; 3.2% for primary government functions; 3% for public works, and 1% for research, education and development. It is announced that Dr. Rosa will be glad to supply copies of this paper if application is made directly to him at the Bureau of Standards, Washington, D. C.

W. R. BELL, commercial agent for the Baton Rouge Electric Co., Baton Rouge, La., since September, 1917, has resigned to accept a similar position with the Haverhill (Mass.) Gas Light Co. Both the Baton Rouge and Haverhill companies are subsidiaries of Stone & Webster, Inc., Boston, and the transfer of Mr. Bell to the Massachusetts company is considered in the light of a promotion. He joined the Baton Rouge company in 1913.

GRAHAM BRIGHT, general engineer of the Westinghouse Electric & Manufacturing Co., will give talks on "Electric Mine Equipment" before the Duluth (Minn.) Engineers Club and the Engineers Club of Northern Minnesota at Virginia on September 20 and 25, respectively.

W. L. SAUNDERS, of the Ingersoll-Rand Co., New York City, and president of the American Manufacturers' Export Association, stated recently that the decline in prices of commodities and decline in bank balances are hopeful signs for future industrial prosperity of the United States. He said that the readjustment now going on should encourage American manufacturers to formulate plans for healthy growth of foreign and domestic business.

C. H. MOHR has been added to the sales force of the Perkins-LeNoir Co., 113 East Franklin street, Baltimore, Md., representative in that territory of the Roller-Smith Co., 233 Broadway, New York City. Mr. Mohr has been connected in the past with the Westinghouse Electric & Manufacturing Co., at East Pittsburgh, Atlanta and Baltimore, and also with the Standard Electric Elevator Co., of Baltimore. He will devote his attention to the various lines of electrical measuring, protective and control apparatus handled by the Perkins-LeNoir Co., and will specialize in the Roller-Smith products, comprising electrical instruments, meters and circuit breakers.

OBITUARY.

HOWARD L. OLDS, member of the executive committee of the New England Section of the National Electric Light Association, died recently at the age of 51 years. At the time of his death he was vice-president of the Twin State Gas & Electric Co., Boston. In 1916 Mr. Olds was in charge of the eastern properties of the Middle West Utilities Co.

JAMES MITCHELL, president and one of the organizers of the Alabama Power Co., died recently at St. James, L. I., N. Y. He was one of the pioneer electrical engineers who perfected the electric street railway system of Denver, Colo., and he also installed the first trolley system in South America.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES.

Hartford, Vt.—Electrical and mechanical equipment will be installed in the new paper and pulp mill to be erected here by the International Paper Co., 45 Milk street, Boston. The structure will be two stories and is estimated to cost $50,000.

Holyoke, Mass.—The Lyman Mills has had plans prepared for extensions and improvements at its cotton mills, to include the installation of a new turbo-generator and auxiliary equipment.

Quincy, Mass.—Bethlehem Shipbuilding Corp., Fore River, near Quincy, has completed plans for the erection of a one-story power house addition at its local shipyard. With other plant extensions, the structure will cost about $75,000.

Springfield, Mass.—Gilbert & Barker Manufacturing Co. has construction under way on a power plant at its machinery works.

Springfield, Mass. — Considerable electrical and mechanical equipment will be installed in the plant to be erected at West Springfield by the Springfield Automatic Machine Screw Co. The company has secured a large site at this place, and the initial buildings are estimated to cost $100,000. I. T. McGregor is president. McClintock & Craig, 33 Lyman street, are architects.

Providence, R. I.—A new power plant will be erected by the Greyhound Motor Corp. in connection with its automobile plant on local site. A number of large works buildings will be constructed, each 100 by 200 ft., and machine equipment electrically operated. The plant is estimated to cost about $100,000, exclusive of machinery. Headquarters of the company are at 5 Columbus Circle, New York. John C. Temple is president.

Albany, N. Y.—The State Hospital Commission has had plans prepared for improvements and extensions in the power plant at one of the state institutions. The work will include new electrical equipment, boilers, coal handling machinery and other apparatus, and is estimated to cost $125,000. E. S. Elwood is secretary.

Buffalo, N. Y.—Bruce Falls Co. has completed negotiations with the government of the Province of Ontario for the establishment of a new timber plant on land in the province. A large power plant for general operation of lumber works will be constructed. The entire project is estimated to cost $1,000,000, including equipment.

Corning, N. Y.—Corning Glass Co. is considering tentative plans for the erection of a power plant at its works.

Glens Falls, N. Y.—It is estimated that close to $1,000,000 will be spent by the International Paper Co. in the development of water power in the Hudson river a short distance above this city. Surveyors are now at work on preliminary plans for the construction of a plant on Sherman's Island and a large dam. Floyd G. Simons, superintendent, 30 Broad street, New York City.

Hamilton, N. Y.—Bonds to the amount of $28,000 have been voted for improving electric light plant. Address town clerk.

Lancaster, N. Y.—Lancaster Light, Power & Conduit Co. has completed plans for the erection of a one-story building, 32 by 90 ft., to cost about $10,000.

New York, N. Y.—New York Edison Co., 103 East Fifteenth street, has filed plans for the erection of its proposed electric substation, Elizabeth and Bayard streets, to cost about $150,000.

New York, N. Y.—The New York Telephone Co., 15 Dey street, has filed plans for extensions and improvements in its three-story exchange building at Convent avenue and One Hundred and Forty-sixth street, comprising a four-story rear addition, to cost about $600,000. Plans have also been completed for alterations and additions to the three-story exchange at 1052 Greene avenue, Brooklyn, to cost about $30,000.

New York, N. Y.—Mexican Telegraph Co., 85-89 Broad street, has acquired property at 29-41 South William street, extending through to Stone street, as a site for the erection of a new building. The property comprises four and five story buildings at the present time and these will be replaced.

New York, N. Y.—Electric Bond & Share Co., 71 Broadway, has arranged for a bond issue of $2,000,000 for one of its subsidiary organizations, the proceeds to be used in part for proposed extensions and improvements. A bond issue has also been perfected for the Southwestern Power & Light Co., El Paso, Tex., totaling $2,000,000, also operated by the Electric Bond & Share Co., for similar purposes.

Niagara Falls, N. Y.—National Carbon Co. has construction under way on a one-story addition to its plant, 90 by 120 ft., to cost about $40,000.

Tonawanda, N. Y.—Manufacturing interests in the River road and Kenmore districts are negotiating with the International Railway Co., Buffalo, for an extension in its lines to this section.

Tottenville, S. I., N. Y.—Richmond Light & Railroad Co. has been making repairs at its Livingston power plant to replace the burning out of a generator late in August; the station was temporarily closed down.

Union Hill, N. Y.—Electrical and mechanical equipment will be installed in the plant to be erected by the Consumers' Hygienic Ice Co., 320 Fulton street, as an extension to its present works. It is estimated to cost $30,000.

Bayonne, N. J.—Tidewater Oil Co. is planning erection of a power house and pumping plant on the Morris canal, Jersey City, N. J.

Bridgeton, N. J. — Considerable electrical and mechanical equipment will be installed by the Illinois Glass Co. in connection with the erection of its proposed local glass works, estimated to cost $3,000,000. The company recently acquired the Cumberland Glass Co., with plant at this place. Headquarters are at Alton, Ill.

Butler, N. J.—The Board of Public Utilities Commissioners has granted the Borough Council permission to issue bonds for $70,000 for the erection of the proposed addition to the municipal electric light and power plant.

Jersey City, N. J.—New York Telephone Co. has filed plans for extensions in its exchange building at 71-77 Madison Avenue, to cost about $80,000.

Keyport, N. J.—Standard Gas Co. has arranged for the installation of new boilers and other equipment at its local plant.

Newark, N. J.—The Board of Freeholders has completed arrangements for the erection of a new power plant at the Isolation Hospital, Soho, to cost about $45,000.

Newark, N. J.—American Brake Shoe & Foundry Co. has filed plans for the erection of a power plant at its works at Avenue L and Edwards street, to cost about $20,000.

Riverton, N. J.—Campbell Soup Co., Camden, N. J., has completed plans for the erection of a power house here, at its local farm. An exhibition building will also be constructed.

Trenton, N. J.—A large power plant for general factory operation will be erected by the Mutual Potteries Co. in connection with the construction of its local factory, estimated to cost $1,000,000, including equipment. This company was recently organized as a subsidiary of the Trenton Potteries Co., Clinton and Ott streets. John A. Campbell is president of both organizations.

Allentown, Pa. — Lehigh Valley Light & Power Co. is reported to have decided to defer the active construction of its proposed steam-electric generating plant at Hauto, Pa. The contract for the work has been awarded to the Phoenix Utility Co., New York, an affiliated organization.

Harrisburg, Pa.—Plans for the electric wiring and equipment of the three state temporary office buildings now being erected in Capitol Park were sent out to prospective bidders by the Department of Public Grounds

and Buildings. Bids will be received and opened Sept. 7. It is expected that the work will cost between $6000 and $7000.

Chambersburg, Pa. — Warmspring Road Telephone Co. has applied to the Public Service Commission for a charter, and for permission to install and operate a system in certain sections of Franklin county.

Erie, Pa.—Lovell Manufacturing Co. has commenced the erection of a one-story power plant at its wringer manufacturing works to cost about $30,000. It will be 20 by 112 feet.

Glassmere, Pa.—Electrical equipment and other apparatus were destroyed in the fire that damaged the plant of the Crucible Fuel Co., August 12, with loss estimated at $25,000.

Jenkintown, Pa.—The Borough Council has awarded a contract to the Philadelphia Suburban Gas & Electric Co. for municipal light and power service. The company has also secured a similar contract from the Borough officials at Cheltenham.

Lancaster, Pa.—H. M. Musser has had plans prepared for the erection of a one-story power house, to be used in connection with his industrial works at 717 North Prince street.

Lancaster, Pa.—L. R. Ambler, W. P. Bolton and Harry L. Long have organized a number of new electric light and power companies, to operate in different parts of the county. Application has been made to the Public Service Commission for permission to allow formation, construction and operation of the different companies. They will be known as the Drumore, East Drumore, Little Britain, Fulton, Coleraine Electric Light & Power companies.

Northumberland, Pa.—Pennsylvania Light, Heat & Power Co. has completed arrangements for the purchase of the Northumberland Gas, Heat & Fuel Co., and has made application to the Public Service Commission to acquire the company.

Philadelphia, Pa.—Electric Storage Battery Co., Nineteenth and Allegheny streets, has filed plans for the erection of a three-story brick plant, 58 by 240 ft., at Adams avenue and Rising Sun lane, to cost about $370,000.

Philadelphia, Pa.—The Department of Public Works is completing plans for extensions and improvements at the Torresdale pumping station, to include the installation of new machinery.

Philadelphia, Pa. — Pennsylvania Railroad Co., Broad street station, has completed plans for the erection of an addition to its substation at the Arsenal bridge.

Philadelphia, Pa.—Bell Telephone Co. has filed plans for extensions and improvements in its exchange building at Seventeenth and Diamond streets.

Scranton, Pa.—Fire on Aug. 21 destroyed the power house and mechanical fan department at the Briggs plant of the Scranton Coal Co., with loss estimated at $200,000, including equipment. The plant will be rebuilt.

Baltimore, Md.—Columbia Graphophone Co., Woolworth building, New York, has filed plans for the erection of a power plant at its new manufacturing plant at Orangeville, Baltimore, to cost about $200,000, including equipment.

Frederick, Md. — The Common Council is perfecting plans for extensions and improvements in the local street-lighting system, to include the installation of a new "white way" system on certain thoroughfares. It is proposed to make extensions in the local power plant, to include the installation of new generating equipment.

Huntington, W. Va.—Borderland Coal Corp. is planning for the rebuilding of the power plant at its No. 2 mine, recently partially damaged by fire, caused by an explosion.

Madison, W. Va.—Madison Water & Light Co. is considering plans for the erection of a local power plant to cost about $25,000.

Northwood, N. C.—Carolina Shale Co will rebuild brick plant recently destroyed by fire. The plant will be operated by electric power. H. M. Morsor general manager.

Wilson, N. C.—Bids will be received Sept. 9 for $110,000 of 6% electric light bonds. Address Theodore A. Hinnant, town clerk.

Littleton, S. C.—Richland Shale Products Co., A. T. Blatchford, general manager, 4309 Ridgewood street, Columbia, S. C., will erect 90-ton capacity tile plant; electric power; to cost $100,000.

Rebecca, Ga.—A committee has been appointed and data secured to formulate plans and means by which the town may have electric lights.

Jacksonville, Fla.—An appropriation of $10,000 will be made in the next city budget for the transfer of the city's electric and power cable to South Jacksonville from the bridge of the Florida East Coast railroad to the new county highway bridge just east of the railroad bridge.

Rochelle, Fla. — Bonds to the amount of $45,000 have been voted to purchase necessary equipment for improving power plant.

NORTH CENTRAL STATES.

Akron, O.—Plans for a boulevard lighting system for Storer avenue have been approved by the city council.

Lansing, Mich.—The city will build electric light plant, etc., at an estimated cost of $50,000. Engineer, O. E. Eckhart, City Hall, Lansing. Architects, Alford & Burdick, 8 South Dearborn street, Chicago.

Mendon, Mich.—Denton Knitting Mills may install an electric light plant for their own use and to supply the needs of the village, owing to the fact that the United Electric Co. is unable to furnish enough power for both places.

St. Johns' Mich.—An election was held Aug. 21 to vote on the question of issuing $42,000 in bonds for improving the water system. It is proposed to expend $16,000 in putting in a 300 h. p. electrically-driven pump at the waterworks plant. A sum of $26,000 will be spent in repairing the city water and light plant.

Chicago, Ill.—Construction of the Amber building on the southeast corner of Desplaines and Adams streets at a cost of $250,000 is to begin within 60 days, according to Jacob M. Weller of Minchin & Weller, architects. The building will be seven stories high, with basement, and will cover the entire lot, 68 by 75 ft. Adolph H. Bernstein, head of the Amber Electrical Supply Co., 553 West Madison street, is the owner of the new building, the exterior of which will be finished in pressed brick and terra cotta. The interior will be of mill construction, with laminated floors, providing for a heavy loading capacity. The structure will be equipped with a sprinkler system, passenger and freight elevators, etc.

Decatur, Ill.—An ornamental lighting system is to be installed on Cobb avenue.

Florence, Wis.—Peninsula Power Co. will construct another dam and power house on the Pine river in the town of Commonwealth, about seven miles south of Florence. This will be the third hydroelectric plant to be built by this company in the vicinity. Plans call for the construction of the dam on the breakwater of the Pine river and the power house will be built one-quarter of a mile below the dam. The dam will develop a 90-ft. head, while the plant on the Brule river develops a 63-ft. head. Address O. C. Davidson, president.

Lone Rock, Wis.—Site being surveyed for dam between Lone Rock and Gotham, to be erected to furnish power for electric current. A. H. Fries. city clerk.

Rice Lake, Wis.—At a special election here it was decided that the city buy the hydroelectric plant of the Wisconsin-Minnesota Light & Power Co.

Redwood Falls, Minn.—Ornamental street lighting postponed during litigation. L. P. Wolff, construction engineer, 1000 Guardian Life building, St. Paul. H. C. Rutter, city clerk.

Windom, Minn.—At a special election $17,000 in bonds were voted for improving power plant and waterworks and $5000 bonds for revolving fund.

Hornick, Ia.—Woodbury county bids in Aug. 20 for construction of electrical distribution system. Owner Hornick Township. E. C. Chelly, city clerk.

Neola, Ia.—At a meeting of the council an ordinance was presented by Edward P. Burns providing for the sale of the municipal electric light plant to the highest bidder and calling a special election to decide whether the sale shall be consummated. The date of the election is Sept. 14.

Eminence, Mo.—Shannon County Copper Mining Co. will build dam and hydroelectric power plant on Jack's Fork. Address L. O. Neider, Springfield, Mo.

Kansas City, Mo.—Plans have been announced by the Kansas City Power & Light Co. for the conversion of the basement of the R. A. Long building into a substation, at an estimated cost of $80,000.

Wentzville, Mo. — The Common Council is having plans prepared for the construction of a municipal electric light and power plant. E. T. Archer & Co., New England building, Kansas City, Mo., is the architect.

Pleasanton, Kan.—Bonds to the amount of $6000 have been voted to purchase electric light plant. The plant will be increased and in addition to furnishing current for Prescott and Fulton, Kan., and Hume, Mo., as is done at present, power will be supplied to the coal mines in the vicinity of Pleasanton.

Scottsbluff, Neb.—City council has been petitioned to construct additional street lighting in residence section of city.

Flandreau, S. D.—Central Telephone Co. will probably spend $60,000 this fall on repairing system in Flandreau, Egan and Coleman.

Candon, N. D.—City contemplates purchasing lighting plant. Address W. A. Martin, manager of city light and telephone plants.

Ellendale, N. D.—Electric transmission line may be constructed from Ellendale to Guelph and probably to Ludden. Owner, Ellendale Electric Co., G. F. Phillips manager.

SOUTH CENTRAL STATES.

Oxford, Miss.—An election was held Aug. 27 to vote on the question of issuing bonds to repair light and water plant. Address the mayor.

Louisville, Miss.—The Town Council has arranged a bond issue of $36,000 for the establishment of a municipal electric light and power plant.

Collinsville, Okla.—The city is considering ways and means to erect dam and intake pumping station on Caney river, also to install 350 kv.-a. generator and 250 hp. boiler; cost $120,000. Address the mayor.

Erick, Okla.—City Manager J. A. Richardson is planning for enlargements and betterments in the municipal electric lighting plant. With other utility improvements, the work is estimated to cost $100,000, with about $25,000 for the electrical installation.

Dallas, Tex.—The county auditor of Dallas county received sealed bids on Aug. 26 for two regulators for the use of the electric lighting system on the viaduct. Plans for these regulators are on file with W. D. Johnson, engineer, Criminal Courts and Jail building. Charles E. Gross, county auditor.

Denison, Tex.—The attorney general has approved an issue of $25,000 in bonds for electric works. Address the mayor.

WESTERN STATES.

Deming, N. Mex.—Plans are being prepared for the construction of a power plant capable of developing 22,000 hp. at the Elephant Butte dam, at an expenditure of approximately $4,000,000. Address J. A. Shepard, Deming.

Polson, Mont.—Rocky Mountain Power Co., Butte, plans to build five dams in Flathead river between Bison Range and where river enters lake.

Astoria, Ore.—Contract has been awarded to the North Coast Electric Co. for 1250 ft. of No. 4 underground cable and equipment for new pier.

Brigham, Utah.—The city is reported to be arranging bond issue of $200,000 to provide funds for rebuilding the municipal light plant in Box Elder Canyon.

Everett, Wash.—A project for power development on the Sultan river and Olney creek in Snohomish county is being worked out by the Sound Power Co. The president of the company is H. O. Pond, 25 Broad street, New York City.

Tacoma, Wash.—A power and heating plant to cost about $200,000, and the installation of electrical equipment to generate 1600 hp.., is planned by the Consumers Central Heating Co.

Portland, Ore.—An extensive development of water power on the south fork of the Coquille river is contemplated by M. J. Anderson, and his application for a permit to appropriate the water has been filed with the state engineering department.

Reedsport, Ore.—At a special election the Reedsport charter was amended so as to permit the issue and disposal of 25-year general obligation bonds in an amount not to exceed $50,000. The proceeds would be used to construct and maintain an electric light and power plant.

Brawley, Cal.—The report of City Engineer George Wade on the municipal power plant will be ready for the trustees at the next meeting. The plan calls for an issue of $200,000 in bonds and the rate is to be 10 cents per kilowatt, instead of the proposed new rate of the Holton Power Co., which is expected to be approximately 16 cents.

CANADA.

Mission City, B. C.—Canada Western Door Co., C. C. Pierce president, Seattle Wash., plans to erect door factory at a cost of $130,000. Individual electric drive will be used for the machinery.

St. Johns, N. B.—Electrification of its plant is planned by the New York Cotton Mills.

Ford City, Ont.—The erection of an automobile body factory is planned by the Fisher Body Co., and in connection with the plant electric light and power equipment will be installed. The architect is Albert Kahn, Walkerville, Ont.

Port Arthur, Ont.—A hydroelectric plant is to be installed at the pulp mill of the Kaministiquia Pulp & Paper Co. at a cost of about $1,000,000.

PROPOSALS.

Albany, N. Y.—The State Prison Commission, C. F. Rattigan, superintendent, is taking bids for improvements and extensions in the power house at the State Prison, Ossining, up to Sept. 15. The installation will comprise considerable electrical work, as well as heating equipment.

Newton, Ill.—Sealed proposals will be received Sept. 8 for one 120 kv-a., N. R. C. or uniflow side crank direct connected steam engine and one 120 kv-a., 3-phase, 2300-volt generator, speed 225 r.p.m. with belter exciter; one 4-panel marine slate or blue Vermont marble switchboard with station wiring. Detailed plans and specifications are on file and can be seen at the office of the city clerk, Newton, and at the office of the engineers, Fuller & Beard, Chemical building, St. Louis. Address John W. Matheny, city clerk, Newton.

Jefferson, O.—Sealed proposals will be received Sept. 10 for the construction of a step-up substation in the power plant of the Pennsylvania & Ohio Traction Co., State road and Kingsville street, Ashtabula, O. The work under the contract includes switchboard in the Pennsylvania & Ohio power plant; step-up transformers and electrolytic lightning arrester, with necessary installation, connections and wiring. Address T. B. Miller, clerk, Village of Jefferson.

Mare Island, Cal.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., and the Public Works Office, Navy Yard. Mare Island, will receive bids on Specification 4127 until Sept. 11 for a lighting protection system in connection with the ordnance buildings to be erected on Mare Island.

FOREIGN TRADE.

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Appliances, Etc. (33,382)—A merchant in Switzerland desires to secure an agency from manufacturers for the sale of electric motors, electric tools, electric appliances, and allied lines. Cash to be paid in New York.

Electrical Materials (33,457) — A commercial agent in Spain desires to purchase and secure an agency for the sale of electrical material, automobile accessories, hardware, and knitting machinery. Correspondence should be in Spanish.

Electric Flash Lamps, Torches, Etc. (33,471)—A manufacturing firm in India desires to purchase electric flash lamps, torches and other novelties and goods. Quotations should be given f. o. b. New York. Cash to be paid. References.

Electrical Supplies (33,482) — A merchant in Italy desires to secure an agency for the sale of electrical supplies, etc. Payment to be cash or confirmed credit. Correspondence may be in English. References.

Electric Equipment (33,485)—A member of a firm in Uruguay is in the United States and desires to purchase electrical equipment. References.

Electric Lighting Supplies, etc. (33,498)—A firm of merchants in Hungary desires to purchase electric lighting supplies, dynamos and electric motors. Reference.

Electrical Goods (33,509)—A commercial agent in Spain desires to secure an agency for the sale of any kind of electrical goods. Quotations should be given c. i. f. Spanish port. Correspondence should be in Spanish or French. References.

Electrical Goods (33,582)—A commercial agency firm in Brazil desires to secure the representation of firms for the sale of electrical goods. Correspondence may be in English. Reference.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

New Issue of Bonds by Great Western Power Co.

Great Western Power Co. of California is issuing $3,500,000 of 8% bonds which will be retired by sinking fund at 105 within ten years. They are secured by general mortgage and will be secured further by deposit of first and refunding bonds, the latter being secured by first mortgage on a plant now being built and by deposit of bonds and stock of underlying companies. Earnings in the last year cover interest on all mortgage bonds, including the new issue, one and one-half times. The earnings of the company for the 12 months ended July 31, 1920, are as follows:

Gross earnings, exclusive of interest during construction	$5,487,236
Operating expenses, taxes, rentals, etc.	2,699,701
Net income	$2,787,535
Annual interest requirement on all outstanding mortgage bonds of the company, including this issue	1,833,030
Balance	$ 954,505
Annual interest requirements on all outstanding debentures	254,592
Surplus over interest charges.	$ 699,913

Cities Service Co.'s Showing.

Cities Service Co. for seven months ended July 31 showed net earnings of $14,454,000 and net income of $13,325,000 with a balance of $10,630,000 after preferred dividends of $2,695,000. Following is report submitted:

	1920.	1919.
July gross	$2,117,919	$1,583,722
Net earnings	2,062,979	1,526,765
Surplus after fixed charges	1,900,084	1,349,973
Seven months' gross.	14,861,219	12,346,540
Net earnings	14,454,379	11,927,628
Surplus after fixed charges	13,325,665	10,811,470

Following a meeting of the board it was announced that a further privilege of conversion of 10% of their holdings on Aug. 1 was extended to holders of Series C 7% debentures. Conversion privilege is effective Sept. 1 or the first day of any month thereafter.

Earnings of Detroit Edison Co.

Detroit Edison Co. in its statement for the 12 months ended June 30, 1920, shows net income after charges and federal taxes, of $2,237,902, equal to $8.09 a share earned on the $27,655,200 capital stock.

Consolidated income account for the 12 months follows:

Gross	$18,970,334
Expenses, federal taxes, etc.	14,759,645
Net earnings	$ 4,210,689
Interest, etc.	1,972,787
Net income	$ 2,237,902
Dividends	2,124,847
Balance	$ 113,055
Previous surplus	2,759,362
Total	$ 2,872,417
Extraordinary charges	303,774
Profit and loss, surplus June 30, 1920	$ 2,568,643

Consolidated balance sheet of Detroit Edison Co., as of June 30, 1920, follows:

Assets: Real estate, plant, equipment, etc., $69,720,128; cash, $2,824,999; notes receivable, $112,913; accounts receivable, $2,959,380; materials and supplies, $4,403,402; prepaid accounts, $325,913; investments and special advances, $3,884,721; debt, discount and expense (amortized during life of bonds), $3,089,527; deferred accounts, $288,131. Total, $87,609,114.

Liabilities: Capital stock, $27,655,200; funded debt, $47,073,300; instalments paid by subscribers to 1930 debentures, $144,500; notes payable, $2,400,000; accounts payable, $2,545,784; accrued liabilities, $1,917,416; permanent and corporate reserves, $55,765; operating reserves, $3,248,506; surplus, $2,568,643. Total, $87,609,114.

Habirshaw Electric Cable Earnings.

Statement submitted by the Habirshaw Electric Cable Co. for the five months ended May 31, 1920, gives combined statement of earnings of the Habirshaw Electric Cable Co., Inc., Electric Cable Co. and the Bare Wire Co. as follows: Sales (not including Bare Wire Co.), $4,846,807; profit in trading, $412,617, from which $163,767 was deducted for interest, discount and bonuses, leaving net income of $248,850.

Southern California Edison Co.

	1920.	1919.
July gross earnings	$1,524,458.28	$1,009,541.10
Expenses and taxes	606,122.45	421,165.62
Net earnings	$ 918,335.83	$ 588,375.48
Fixed charges	272,216.05	257,216.20
Balance	$ 646,119.78	$ 331,159.28
12 months ending July 31, 1920:		
Gross earnings	$12,305,371.73	$9,713,353.88
Expenses and taxes	5,499,124.85	3,798,268.03
Net earnings	$6,806,246.88	$5,915,085.85
Fixed charges	3,055,846.27	3,089,336.88
Balance	$3,750,400.61	$2,825,748.97

Great Western Power System.

	1920.	1919.
July gross	$ 592,087	$ 451,535
Net after taxes	350,006	239,450
Surplus after interest charges	194,514	97,275
Twelve months' gross	5,836,793	5,122,855
Net after taxes	3,236,704	3,016,731
Surplus after interest charges	1,392,520	1,455,371

Columbia Gas & Electric Earnings for Seven Months.

Columbia Gas & Electric Co. for the seven months ended July 31, 1920, reports gross earnings of $8,480,636, an increase of $1,575,131 over the corresponding period of 1919. Net earnings after taxes including miscellaneous income amounted to $5,909,082, an increase of $1,284,250 over last year. Surplus after fixed charges and available for dividends was $2,990,343, an increase of $1,044,147.

United Light & Railways.

United Light & Railways Co. and subsidiaries for 12 months ended July 31, 1920, report largest gross business in their history, amounting to $11,178,303, against $9,847,956 for the preceding 12-month period. Net earnings available for dividends amounted to $1,322,566, against $1,158,126 a year ago. Statement follows:

12 mos. to July 31:	1920.	1919.
Gross	$11,178,303	$9,847,956
Net after taxes	3,155,150	2,929,045
Surplus after charges	1,322,566	1,158,126

Virginia Railway & Power Co.

	1920.	1919.
July gross	$ 892,134	$ 756,135
Net earnings	284,963	303,228
Total income	297,886	316,768
Surplus after charges	99,249	136,602

Dividends.

Manhattan Electrical Supply Co. has declared a stock dividend of 10%, payable Oct. 15 to common stockholders of record Sept. 20.

Connecticut Power Co. has declared its regular quarterly dividend of 1½% on its preferred stock, payable Sept. 1 to stockholders of record Aug. 20.

Colorado Power Co. has declared its regular quarterly dividend of 1¾% on its preferred stock, payable Sept. 15 to stockholders of record Aug. 31.

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent	Bid Aug. 24.	Bid Aug. 31.
Adirondack Electric Power of Glens Falls, common	6	14	13
Adirondack Electric Power of Glens Falls, preferred	6	72	71
American Gas & Electric of New York, common	10+extra	95	91
American Gas & Electric of New York, preferred	6	34	33
American Light & Traction of New York, common	..	110	111
American Light & Traction of New York, preferred	6	81	81
American Power & Light of New York, common	4	45	41
American Power & Light of New York, preferred	6	67	65
American Public Utilities of Grand Rapids, common	..	3	3
American Public Utilities of Grand Rapids, preferred	7	11	12
American Telephone & Telegraph of New York	..	98	97
American Water Works & Elec. of New York, common	..	2	2
American Water Works & Elec. of New York, particip	7	5	4
American Water Works & Elec. of New York, 1st preferred	..	37	38
Appalachian Power, common	..	1	1
Appalachian Power, preferred	7	15	15
Cities Service of New York, common	+extra	292	292
Cities Service of New York, preferred	6	66	65
Commonwealth Edison of Chicago	8	102	100
Comm. Power, Railway & Light of Jackson, common	..	16	15
Comm. Power, Railway & Light of Jackson, preferred	6	36	36
Federal Light & Traction of New York, common	..	7	6
Federal Light & Traction of New York, preferred	..	40	39
Northern States Power of Chicago, common	..	29	29
Northern States Power of Chicago, preferred	ex.div.7	74	74
Pacific Gas & Electric of San Francisco, common	..	46	46
Public Service of Northern Illinois, Chicago, common	7	66	65
Public Service of Northern Illinois, Chicago, preferred	6	84	83
Standard Gas & Electric of Chicago, common	..	12	13
Standard Gas & Electric of Chicago, preferred	6	35	35
Tennessee Railway, Light & Power of Chattanooga, common	..	1	1
Tennessee Railway, Light & Power of Chattanooga, preferred	6	2½	2
Western Power of San Francisco, common	..	18	18
Western Union Telegraph of New York	extra	84	85
Industrials—			
Electric Storage Battery of Philadelphia, common	4	96	20
General Electric of Schenectady	8	141	141
Westinghouse Electric & Mfg. of Pittsburgh, common	7	47	46